Physicsaholics

DPP – 2

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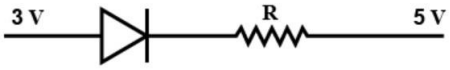
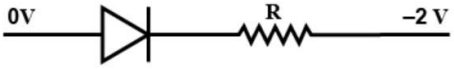
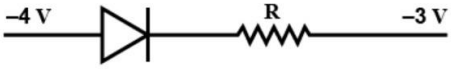
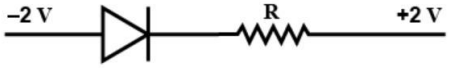
Q 1. PN-junction diode works as an insulator, if connected
(a) To A.C. (b) In forward bias
(c) In reverse bias (d) None of these

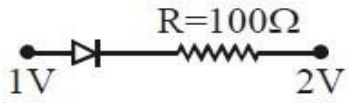
Q 2. Which one of the following represents forward bias diode?
(a) 

(b) 

(c) 

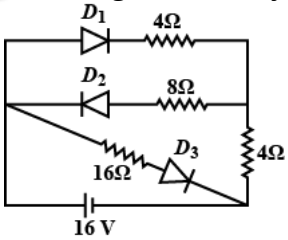
(d) 

Q 3. Assuming that the junction diode is ideal, the current in the arrangement shown in the figure is



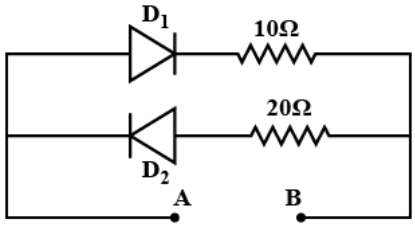
(a) 0 mA (b) 2 mA
(c) 10 mA (d) 30 mA

Q 4. In the given circuit, the current through the battery is:



(a) 1.5 A (b) 2 A
(c) 3 A (d) 5.33 A

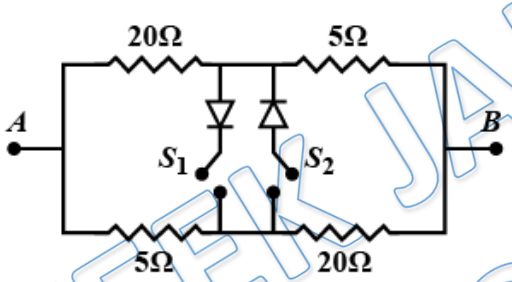
Q 5. Two ideal junction diodes D_1, D_2 are connected as shown in the figure. A 3V battery is connected between A and B. The current supplied by the battery, if its positive terminal is connected to A, is



(a) 0.1 A (b) 0.3 A
(c) 0.9 A (d) 90 A

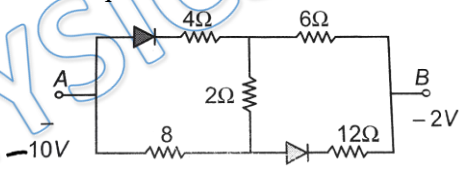
Q 6. In a reverse biased diode, when the applied voltage changes by 1V, the current is found to change by 0.5μA. The reverse bias resistance of the diode is
(a) $2 \times 10^5\ \Omega$ (b) $2 \times 10^6\ \Omega$
(c) 200 Ω (d) 2 Ω

Q 7. In the circuit shown below, V_A and V_B are the potentials at A and B, R is the equivalent resistance between A and B, S_1 and S_2 are switches, and the diodes are ideal



(a) If $V_A > V_B$, S_1 is open and S_2 is closed then R = 8 Ω
(b) If $V_A > V_B$, S_1 is closed and S_2 is open then R = 10.5 Ω
(c) If $V_A > V_B$, S_1 is open and S_2 is closed then R = 12.5 Ω
(d) If $V_A > V_B$, S_1 is closed and S_2 is open then R = 8 Ω

Q 8. In the following circuit the equivalent resistance between A and B is



(a) $\frac{20}{3}$ Ω (b) 10 Ω
(c) 16 Ω (d) 20 Ω

Q 9. The reverse biasing in a PN junction diode
(a) Decreases the potential barrier
(b) Increases the potential barrier
(c) Increases the number of minority charge carriers
(d) Increases the number of majority charge carriers

Q 10. On increasing the reverse bias to a large value in a p-n junction diode, current
(a) Increases slowly
(b) Remains fixed
(c) Suddenly increases
(d) Decreases slowly

Q 11. The electric field in the depletion layer of an unbiased p-n junction is
(a) zero (b) from P-side to N-side
(c) from N-side to P-side (d) not defined

Q 12. A potential barrier of 0.3 V exists across a p-n junction. An electron with speed 5×10^5 m/sec approaches this p-n junction from n-side, what will be its speed on entering the p-side?
(a) $4.8 \times 10^5\, m/s$ (b) $3.8 \times 10^5\, m/s$
(c) $5.8 \times 10^5\, m/s$ (d) $6.8 \times 10^5\, m/s$

Q 13. In a p-n junction, the thickness of depletion region is 2×10^{-7} m and potential barrier across the junction is 0.20 V. What will be the intensity of electric field in this region?
(a) 10^6 V/m
(b) 10^7 V/m
(c) 4×10^{-7} V/m
(d) 1.4×10^{-6} V/m

Q 14. In a photo diode the conductivity increases when the material is exposed to light. It is found that the conductivity changes only if the wavelength of incident light is less than 500 nm. What is the band gap? Use $h = 6.6 \times 10^{-34}$Js, $c = 3 \times 10^8$ m/s.
(a) 2 eV (b) 1.81 eV
(c) 2.48 eV (d) 0.86 eV

Q 15. An LED is constructed from a P-N junction based on a certain semi-conducting material whose energy gap is 1.9 eV. Then the wavelength of the emitted light is
(a) 2.9×10^{-9}m (b) 1.6×10^{-8}m
(c) 6.5×10^{-7}m (d) 9.1×10^{-5}m

Q 16. If the input frequency is 50 Hz. In half - wave rectification, what is the output frequency? And What is the output frequency of a full - wave rectifier for the same input frequency?
(a) 50 Hz, 25 Hz (b) 25 Hz, 50 Hz
(c) 50 Hz, 100 Hz (d) 25 Hz, 100 Hz

Q 17. In half wave rectifier, a p-n diode with internal resistance 20 Ω is used. If the load resistance of 2 KΩ is used in the circuit, then the efficiency of this half wave rectifier is (in percentage)
(a) 40.6 % (b) 40.2 %
(c) 38.4 % (d) 42.8 %

Q 18. In full-wave rectifier, a p-n junction diodes with internal resistance 20 Ω is used. If the load resistance of 980Ω is used in the circuit, then the efficiency is nearly
(a) 37.5 % (b) 79.57 %
(c) 25 % (d) 50 %

Q 19. In the half wave rectifier circuit operating with 50Hz mains frequency. The fundamental frequency in the ripple will be

(a) 100 Hz (b) 20 Hz
(c) 50 Hz (d) 25 Hz

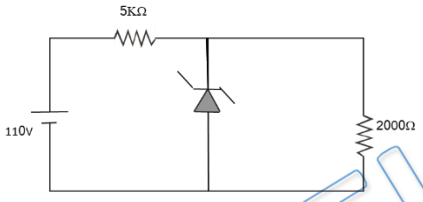
Q 20. If the rms value of sinusoidal input to a full wave rectifier is $\frac{V_0}{\sqrt{2}}$, then the rms value of the rectifier's output is?

(a) $\frac{V_0}{\sqrt{2}}$ (d) $\frac{V_0^2}{\sqrt{2}}$
(c) $\frac{V_0^2}{2}$ (d) $\sqrt{2}V_0$

Q 21. The value of form factor in case of full wave rectifier is:

(a) 1.11 (b) 1.57
(c) 1.27 (d) 0.48

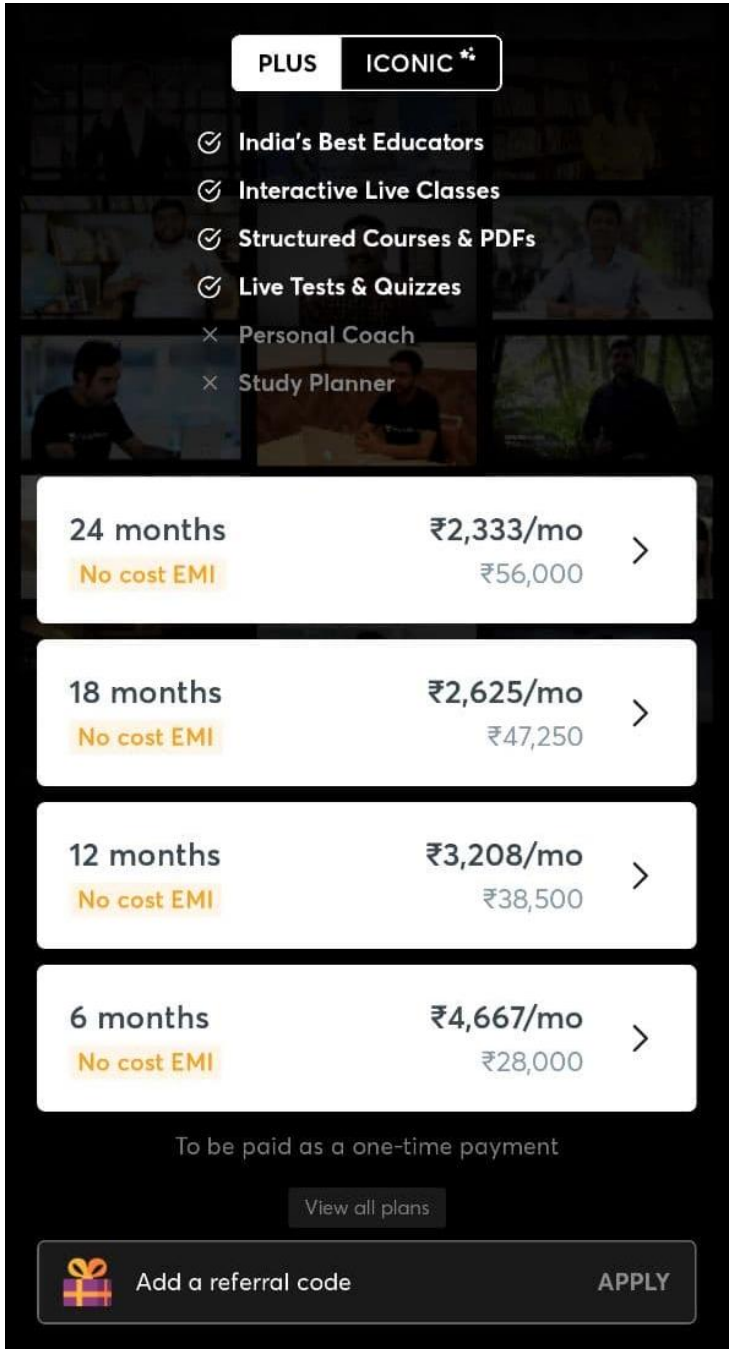
Q 22. In given circuit If breakdown voltage across Zener diode is 10 V, Find current through Zener diode ?



(a) 10 mA (b) 20 mA
(c) 15 mA (d) 25 mA

Answer Key

Q.1 c	**Q.2 b**	**Q.3 a**	**Q.4 c**	**Q.5 b**
Q.6 b	**Q.7 a**	**Q.8 c**	**Q.9 b**	**Q.10 c**
Q.11 c	**Q.12 b**	**Q.13 a**	**Q.14 c**	**Q.15 c**
Q.16 c	**Q.17 b**	**Q.18 b**	**Q.19 c**	**Q.20 a**
Q.21 a	**Q.22 c**			



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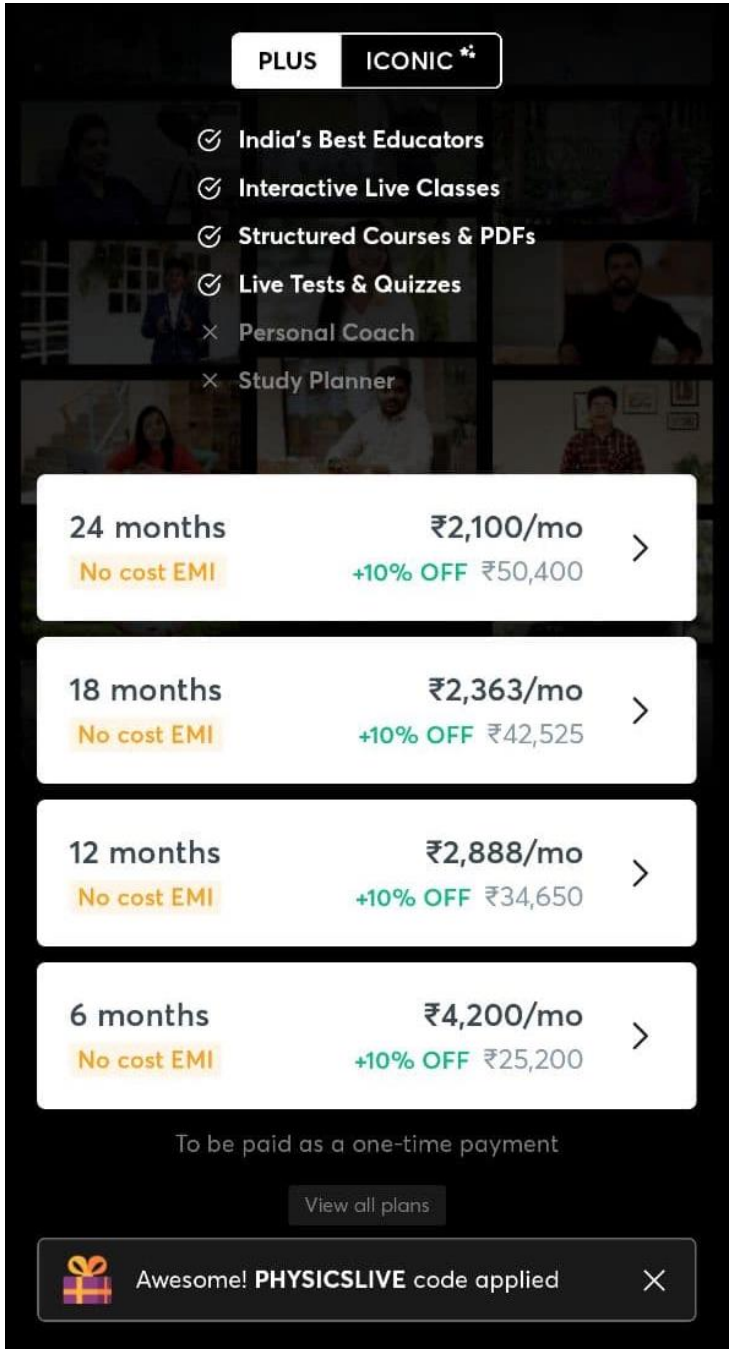


NEET & JEE Main
Written Solution

DPP-2 Semi Conductors: P-N Junction, Diode, Photodiode, Zener Diode Rectifier

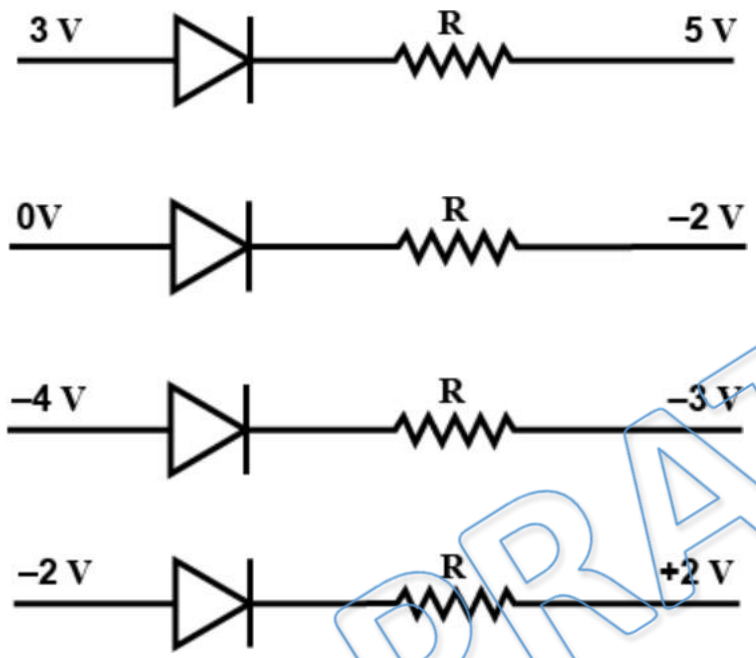
By Physicsaholics Team

Solution: 1

PN− junction diode works as a insulator, if connected in reverse bias with no current flows.

Ans. c

Solution: 2



$3V < 5V$ [R.B.]

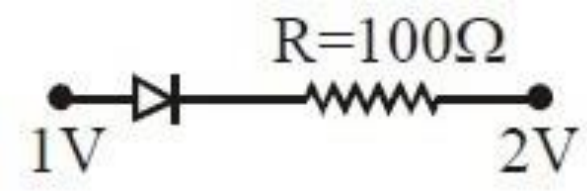
$0V > -2V$ [F.B.]

$-4V < -3V$ [R.B.]

$-2V < 2V$ [R.B.]

Ans. b

Solution: 3



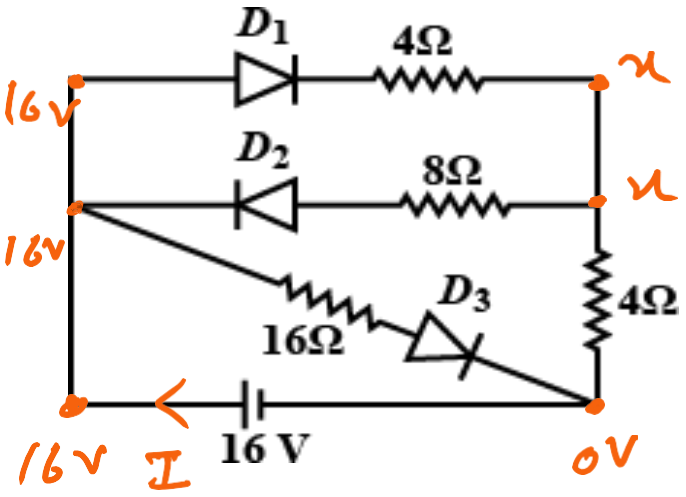
$\therefore \quad 1V < 2V$

so, diode is in reverse bias

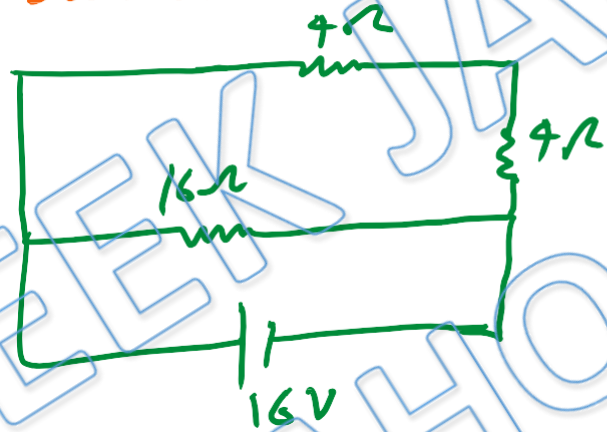
$\Rightarrow$ so, current will not flow in circuit.

Ans. a

Solution: 4

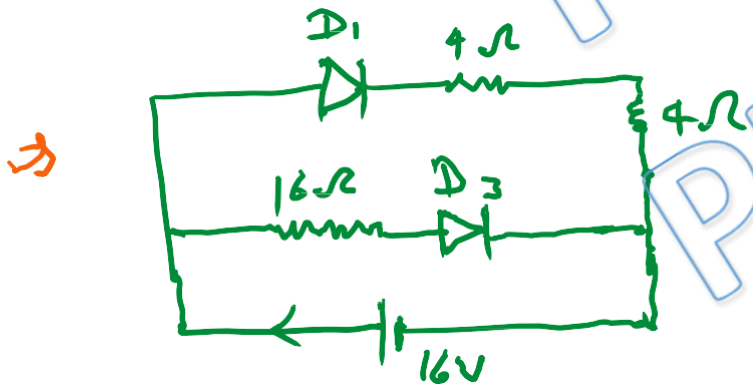


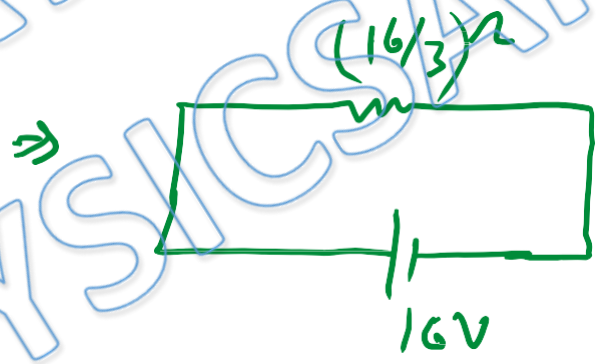
D_1 & D_3 are in forward biase; so they will not offer any resistance in circuit.



$I = 3$ Amp. Ans

D_2 is in reverse biase; so no current will flow through it.

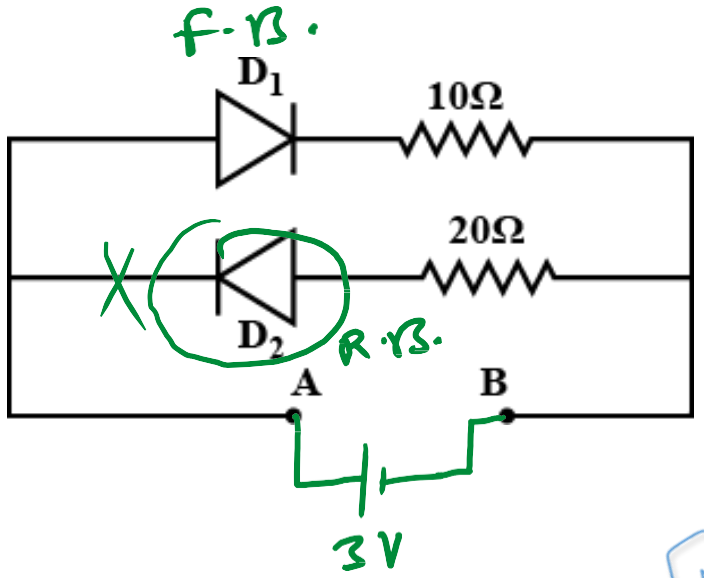




$I = \frac{16}{(16/3)} = 3$ Amp

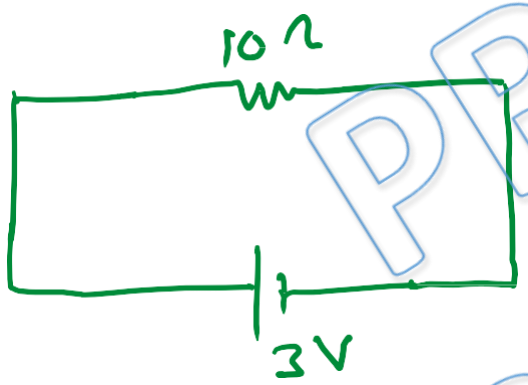
Ans. c

Solution: 5



$$I = \frac{3}{10}$$

$$I = 0.3\,A \quad \text{Ans.}$$



Ans. b

Solution: 6

$$R = \frac{\Delta V}{\Delta I}$$

$$R = \frac{1}{0.5 \times 10^{-6}}$$

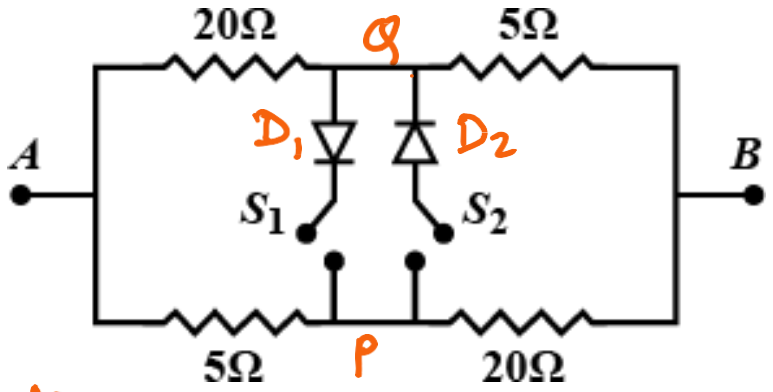
$$R = \frac{1}{0.5} \times 10^{6}$$

$$R = \frac{10}{5} \times 10^{6}$$

$$\boxed{R = 2 \times 10^{6}\ \Omega} \quad \text{Ans.}$$

Ans. b

Solution: 7



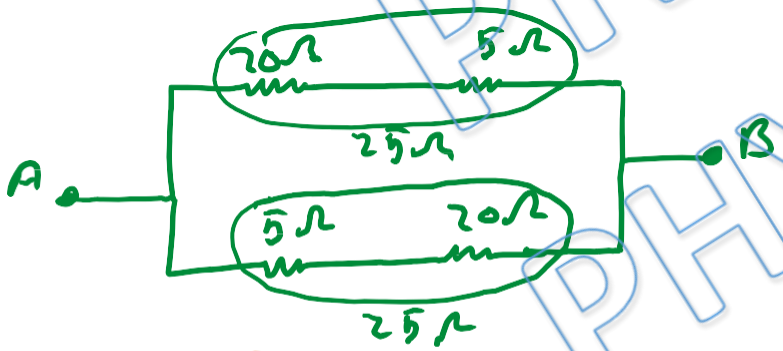
$V_A > V_B$

S_1 is closed & S_2 is open

$\Rightarrow$ as $(5\Omega) < (20\Omega)$

P will be at heigh potential

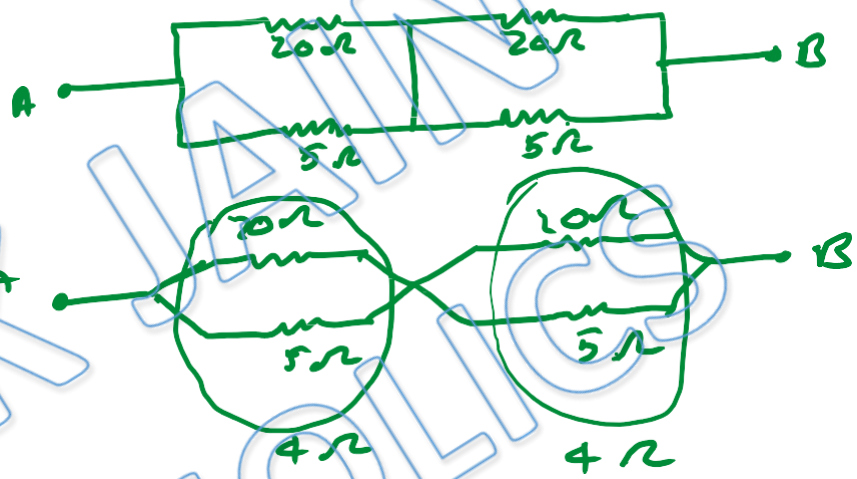
So, D_2 is reverse biased.



$R = \frac{25}{2} \Rightarrow$ **$R = 12.5\ \Omega$**

$V_A > V_B$; S_1 open & S_2 closed

D_2 is forward biased.

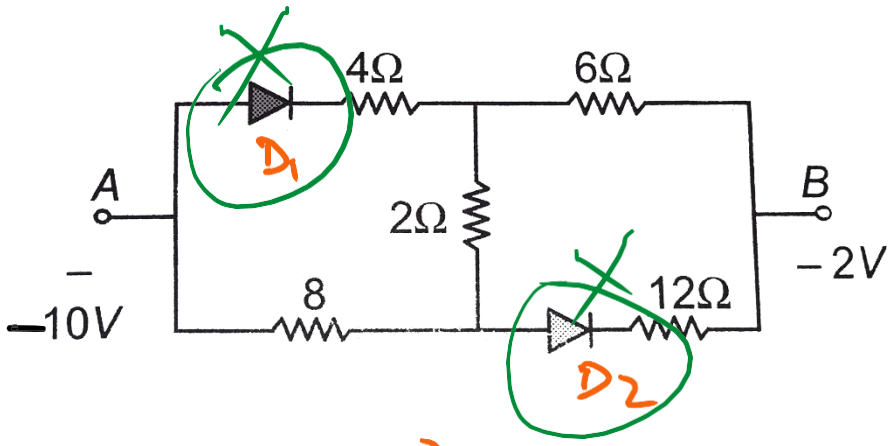


$R = 4 + 4$

$R = 8\ \Omega$

Ans. a

Solution: 8



∵ $-10 < -2$

so, $V_B > V_A$

current will flow from B to A in circuit

⇒ so, Both diodes; D_1 & D_2 will be in reverse biase.

$R = 8 + 2 + 6$

$R = 16\ \Omega$ Ans.

Ans. c

Solution: 9

When a p-n junction is reversed biased, the negative terminal of the battery attracts the free holes in the p-type towards itself whereas the positive terminal attracts the free electrons in n-type towards itself. Hence, the electrons and the holes move away from the junction which results in increasing of the depletion width as well as the potential barrier.

Ans. b

Solution: 10

Reverse biasing means, we connect the positive terminal of the battery to n side of the diode and the negative terminal of the battery to p side of the diode.

Here the diode does not conduct with the change in applied voltage. The current remains constant at a negligibly small value for a long range of applied voltage. When the voltage is raised above a particular point then the current suddenly shoots (increases suddenly). This is called Breakdown of PN-Junction diode..

Ans. c

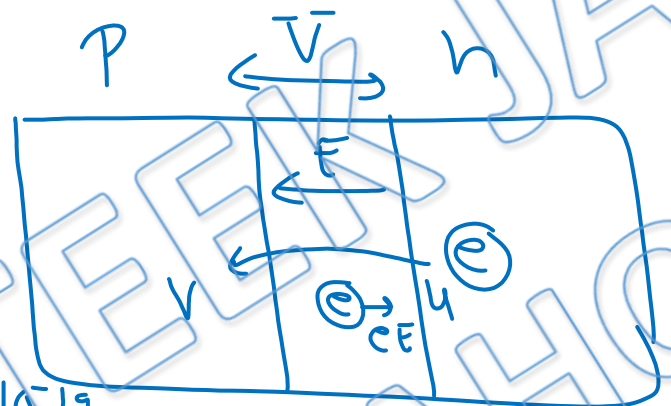
Solution: 11

After joining p-type and n-type semiconductors, electrons from the n-region near the p-n interface tend to diffuse into the p region. As electrons diffuse, they leave positively charged ions (donors) in the n region. Likewise, holes from the p-type region near the p-n interface begin to diffuse into the n-type region, leaving fixed ions (acceptors) with negative charge. Hence, the regions nearby the p-n interfaces lose their neutrality and become charged, with positive charge on n-side and negative charge on p-type. Thus, the electric field in the depletion layer of an unbiased p-n junction is from n-side to p-side.

Ans. c

Solution: 12

$$\frac{1}{2}mu^2 - \frac{1}{2}mv^2 = eV$$



$$\frac{1}{2}\times 9.1\times 10^{-31}\left[25\times 10^{10} - v^2\right] = 3\times 1.6\times 10^{-19}$$

$$25\times 10^{10} - v^2 = \frac{.96}{9.1}\times 10^{-19}\times 10^{31}$$

$$= \frac{.96}{9.1}\times 10^{12}$$

$$v^2 = 25\times 10^{10} - \frac{96}{91}\times 10^{10} \simeq (25 - 9.5)\times 10^{10}$$

$$v = 3.8\times 10^5 \text{ m/s}$$

Ans. b

Solution: 13

$d = 2 \times 10^{-7}\ m$

$\Delta V = 0.20\ V$

$E = \frac{\Delta V}{d}$

$E = \frac{0.2}{2 \times 10^{-7}}$

$E = 10^6\ V/m$ Ans.

Ans. a

Solution: 14

$$\Delta E = \frac{hc}{\lambda_{max}}$$

$$= \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{500 \times 10^{-9}}$$

$$= \frac{19.8 \times 10^{-26}}{5 \times 10^{-7}}$$

$$\Delta E = 3.96 \times 10^{-19} \text{ J}$$

$$\Delta E = \frac{3.96 \times 10^{-19}}{1.6 \times 10^{-19}} \text{ eV}$$

$$\boxed{\Delta E = 2.48 \text{ eV}} \quad \text{Ans.}$$

Ans. c

Solution: 15

$$\Delta E = \frac{hc}{\lambda}$$

$$\Delta E = \frac{1240}{\lambda\,(nm)}$$

$$\lambda = \frac{1240}{\Delta E}\ nm$$

$$= \frac{1240}{1.9}\ nm$$

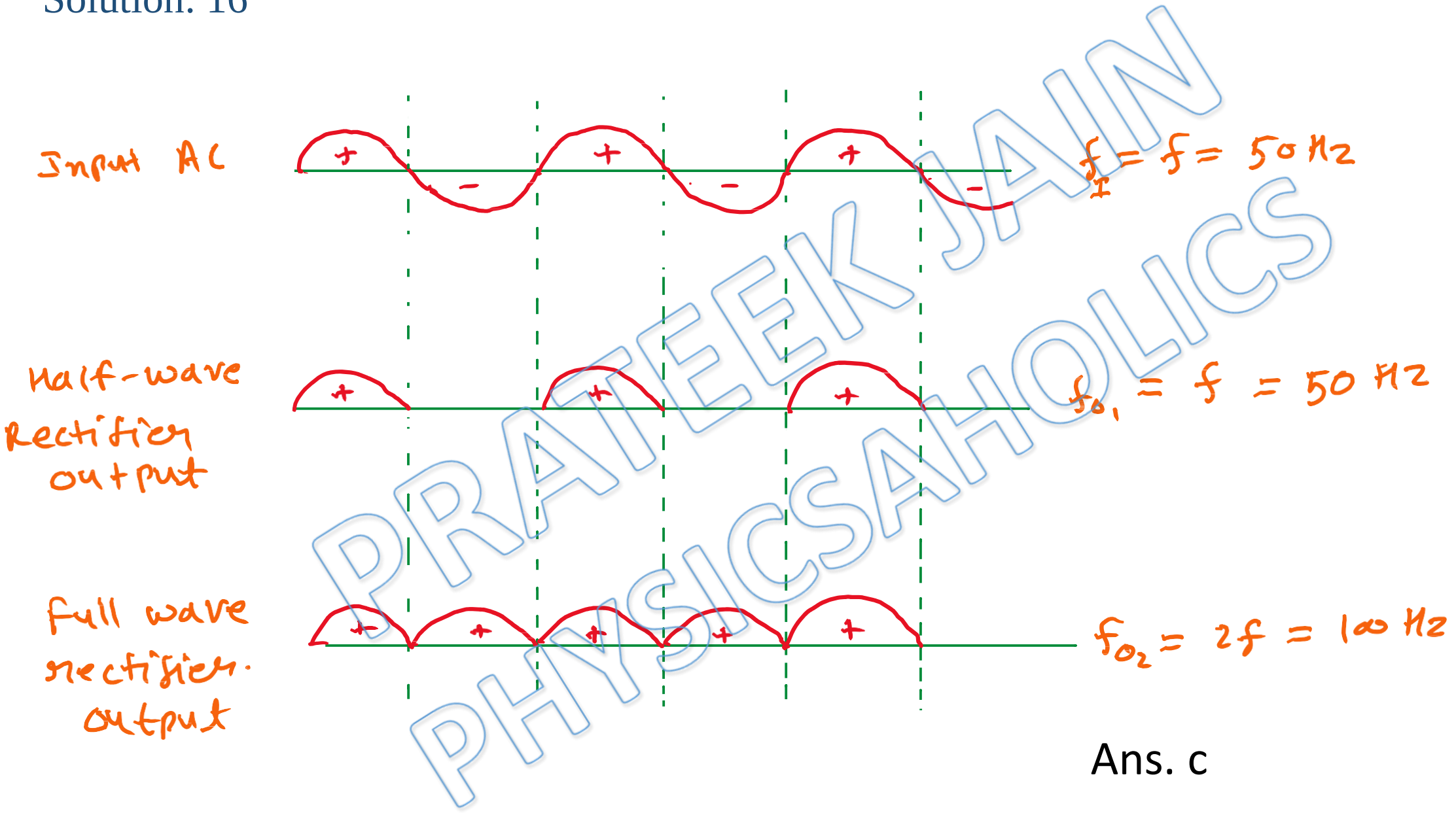
$$= 652.6\ nm$$

$$= 652.6 \times 10^{-9}\ m$$

$$\boxed{\lambda = 6.5 \times 10^{-7}\ m}\ \text{Ans.}$$

Ans. c

Solution: 16



Ans. c

Solution: 17

efficiency of half wave rectifier $\eta = \dfrac{40.6\%}{1 + \dfrac{r_f}{R_L}}$

$$\eta = \frac{40.6\%}{1 + \frac{20}{2 \times 10^3}}$$

$$= \frac{40.6}{2020} \times 2000$$

$$= \frac{40.6 \times 2000}{2020}$$

$$\eta = 40.2\% \quad \text{Ans.}$$

Ans. b

Solution: 18

efficiency of half wave rectifier $\eta = \dfrac{81.2\%}{1 + \dfrac{r_f}{R_L}}$

$$\eta = \frac{81.2\%}{1 + \frac{20}{980}}$$

$$\eta = \frac{81.2}{1000} \times 980$$

$$\boxed{\eta = 79.57\%} \quad \text{Ans}$$

Ans. b

Solution: 19

The output is obtained only for half cycle in half wave rectifier. Therefore, the fundamental frequency of the ripple is same as that of the input i.e. 50Hz.

Ans. c

Solution: 20

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

$$V_{max} = \sqrt{2}\, V_{rms} = \sqrt{2}\,\frac{V_0}{\sqrt{2}} = V_0$$

in output voltage.

$$(V_{rms})_{output} = \frac{V_{max}}{\sqrt{2}}$$

$$\boxed{(V_{rms})_{output} = \frac{V_0}{\sqrt{2}}} \quad \text{Ans}$$

Ans. a

Solution: 21

form factor for full wave rectifier:

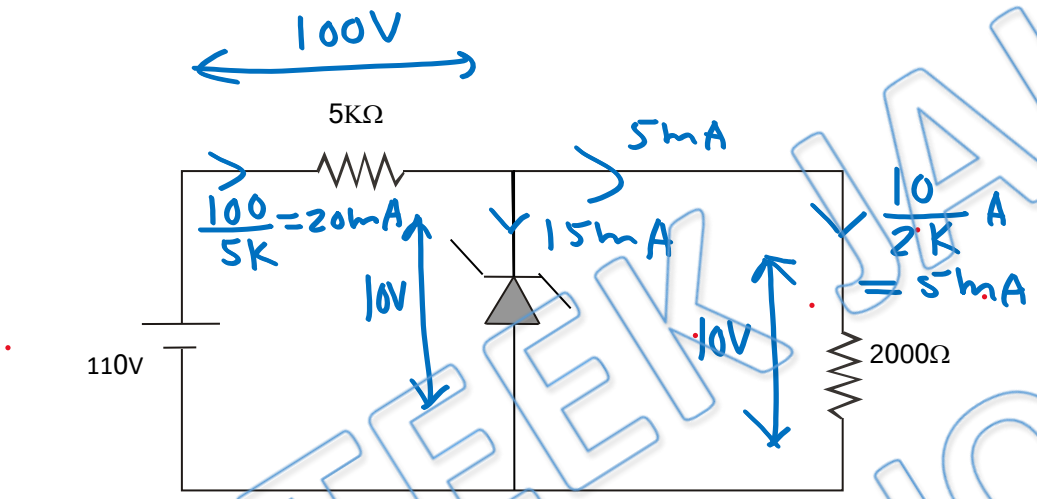
$$f = \frac{I_{rms}}{I_{DC}}$$

$$\boxed{f = \frac{\pi}{2\sqrt{2}}}$$

$$\boxed{f = 1.11} \quad \text{Ans}$$

Ans. a

Solution: 22



$I_z \approx 15\ mA$

Ans. c

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