JEE MAIN ANSWER KEY & SOLUTIONS

SUBJECT :- PHYSICS
CLASS :- 12th **PAPER CODE :- CWT-10**
CHAPTER :- SEMICONDUCTOR

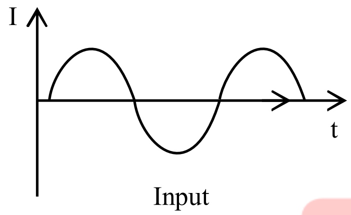
ANSWER KEY

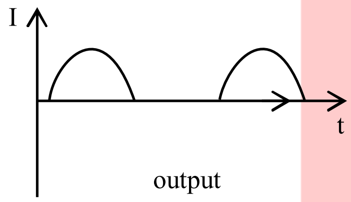
1.	(C)	**2.**	(C)	**3.**	(A)	**4.**	(A)	**5.**	(B)	**6.**	(A)	**7.**	(C)
8.	(D)	**9.**	(C)	**10.**	(D)	**11.**	(A)	**12.**	(B)	**13.**	(A)	**14.**	(A)
15.	(C)	**16.**	(C)	**17.**	(C)	**18.**	(A)	**19.**	(B)	**20.**	(B)	21.	5
22.	1250	23.	9	24.	2	25.	5	26.	14	**27.**	25	28.	120
29.	3	30.	25										

SOLUTIONS

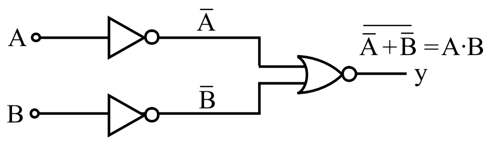
1. (C)

2. (C)
Sol. The diode will be forward biased in one half cycle and will conduct where as it will be reverse biased in negative half cycle and will not conduct.





3. (A)
Sol.



The out put will be of AND gate.

A	B	Y = A·B
0	0	0
0	1	0
1	0	0
1	1	1

The output will be high only when both the inputs are high hence correct .

4. (A)
Sol. $\alpha = \frac{I_c}{I_e} = \frac{I_c}{I_c + I_b} = 0.985$

$I_c = 0.985\ (I_c + I_b)$
$I_c = 0.985\ I_c + 0.985\ I_b$
$0.985\ I_b = 0.015\ I_c = 0.015 \times 2$ mA

$I_b = \frac{0.015 \times 2}{0.985} = 0.03$ mA

$I_b \approx 0.03$ mA

5. (B)
Sol. $Y = \overline{\overline{A}.\overline{B}} = A + B$ i.e. OR gate

6. (A)
Sol. Phosphorus is V group element.

7. (C)
Sol. n-type semi-conductor is neutral, net charge is zero.

8. (D)
Sol. $E = \frac{hc}{\lambda}$

$\lambda = \frac{19.8 \times 10^{-26}}{1.10 \times 1.6 \times 10^{-19}} = 11284$ Å

9. (C)

10. (D)
Sol. $E_{in} = \frac{\Delta V_b}{d} = \frac{0.6}{10^{-6}} = 6 \times 10^5$ V/m

11. (A)
Sol. $I = \frac{V_{net}}{R_{net}} = \frac{8 - 0.5}{2.2 \times 10^{-3}}$ Amp.

$= \frac{7.5}{2.2}$ mA = 3.4 mA

12. (B)
Sol. $\frac{A_P}{A_R} = \frac{\alpha^2 A_R}{A_R} = \alpha^2$

13. (A)
Sol. $\beta = \frac{\Delta I_C}{\Delta I_B} \Rightarrow \Delta I_C = \beta \times \Delta I_B = 80 \times 250\mu A$

14. (A)
Sol. Upper diode is in forward bias,
So, i = V/R = 2V/20Ω = 0.1 A

15. (C)
16. (C)

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

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

17. (C)

Sol. 400 i_1 = 4

$i_2 = 10^{-2}$ 400I_3 = 4

$I_3 = 10^{-4}$

i = $\frac{8}{400}$ = 2 × 10^{-2}

$i_2 = 10^{-2}$

P = 4 × 10^{-2}

P = 40 mw

18. (A)

19. (B)

Sol. I = $\frac{5}{50}$ A

20. (B)

Sol. P = VI ⇒ I = $\frac{P}{V} = \frac{100}{0.5}$ × 10^{-3},

I = $\frac{1}{5}$

I = $\frac{V_{net}}{R_{net}} = \frac{1.5-0.5}{R} = \frac{1}{R}$

R = 5

21. 5

Sol. VRC = ICRC

0.6 = (IC)(600)

IC = 1 mA

IB = $\frac{I_C}{\beta} = \frac{1mA}{20} = 0.5mA$

0.5 × 10 = 5

22. 1250

Sol. AP = AVB $\because |A_V| = B\frac{R_0}{R_i}$

∴AP = $\frac{A_v^2}{\left(\frac{R_0}{R_i}\right)} = \frac{(50)^2}{(200/100)} = \frac{2500}{2} = 1250$

23. 9

Sol. I = n_eAv_d

$\frac{I_e}{I_h} = \frac{n_e \times (v_d)_e}{n_h \times (v_d)_h}$

Here, $\frac{n_e}{n_h} = \frac{7}{5}$, $\frac{I_e}{I_h} = \frac{7}{4}$

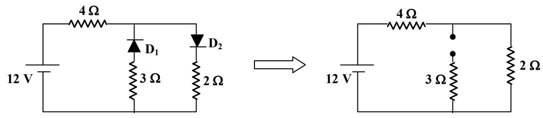
$\frac{7}{4} = \frac{7}{5} \times \frac{(v_d)_e}{(v_d)_h} \Rightarrow \frac{(v_d)_e}{(v_d)_h}$

$= \frac{5}{7} \times \frac{7}{4} = \frac{m}{n}$

Here m = 5 & n = 4 then m + n = 9.

24. 2

Sol



amp ∴ (4) is correct

25. 5

Sol. nenh = n_i^2

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

26. 14

Sol. Conserving energy,

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

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

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

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

$\Rightarrow v = 14$

27. 25

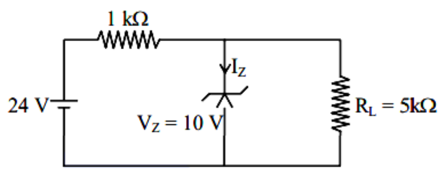
Sol. $B = \frac{I_C}{I_B}$ $I_C = \frac{0.6}{1000} = 6\times10^{-4}A$

$24 = \frac{6\times10^{-4}A}{I_B}$

$I_B = \frac{1}{4}\times10^{-4}A = 25\times10^{-6}A$

28. 120

Sol.



$i = \frac{10V}{5k\Omega} = 2mA$

$I = \frac{14V}{1k\Omega} = 14mA$

∴ $I_Z = I_ZV_Z$ = 120 mW

29. 3

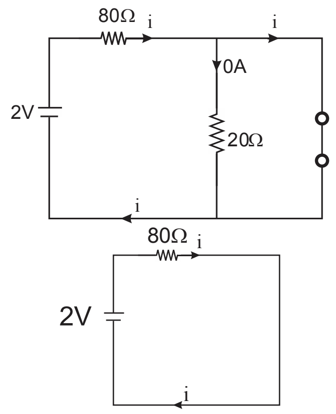
Sol. Energy corresponding to wavelength 4000Å

$$E = \frac{hc}{\lambda} = \frac{12400}{400}$$

= 3.1 eV $\simeq$ 3 eV

30. 25

Sol. Diode or forward biased



$$i = \frac{2}{80} = 0.025 \quad A = 25mA$$