DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 10

Topic :- SEMICONDUCTOR ELECTRONICS: MATERIALS,DEVIES AND SIMPLE CIRCUITS

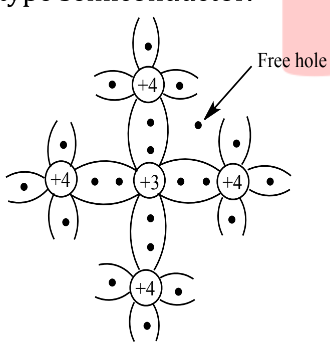
1 **(b)**

$$\beta = \frac{I_c}{I_b} = \frac{I_e - I_b}{I_b} = \frac{I_e}{I_b} - 1 \text{ or } \frac{I_e}{I_b} = 1 + \beta$$

or $I_b = \frac{I_e}{1+\beta} = \frac{8.2}{1+40} = \frac{8.2}{41} = 0.20$ mA.

2 **(b)**

When an impurity atom with 3 valence electrons (as aluminium) is introduced in a pure silicon crystal, all the three of its valence electrons form covalent bonds with one each valence electrons of the nearest silicon atom while the valence electron of the fourth nearest silicon atom is not able to form the bond, leading to formation of hole or p-type semiconductor. While phosphorus being a pentavalent impurity leads to formation of n-type semiconductor.



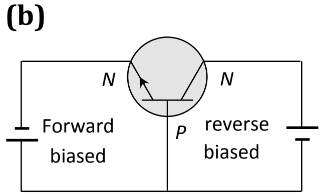
3 **(a)**

$$g_m = \left(\frac{\Delta I_p}{\Delta V_g}\right)_{V_p = \text{constant}} = \frac{(7.5 - 5.5)}{-1.2 - (-2.2)} = 2m\, mho$$

4 **(b)**

For 'AND' gate, if output is 1 then both inputs must be 1

6 **(b)**

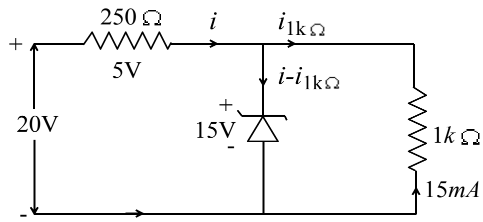


7 **(b)**

$V_{peak} = \sqrt{2}\,V_{rms} = \sqrt{2} \times 141.4 = 200\ V$

8 **(b)**

Voltage across zener diode is constant



$i_{1k\Omega} = \dfrac{15\ volt}{1k\Omega} = 15mA$

$i_{250\Omega} = \dfrac{(20-15)V}{250\Omega} = \dfrac{5V}{250\Omega} = \dfrac{20}{1000}A = 20mA$

$\therefore i_{\text{zener diode}} = (20-15) = 5\ mA$

9 **(a)**

In forward biasing, resistance of PN junction diode is zero, so whole voltage appears across the resistance

10 **(d)**

$\beta = \dfrac{I_c}{I_b} > 1$ or $I_c > I_b$.

11 **(c)**

In forward biasing of PN-junction diode, current mainly flows due to the diffusion of majority charge carriers

12 **(b)**

$\mu = r_p \times g_m = 20 \times 2.5 = 50$

From $A = \frac{\mu R_L}{r_p + R_L} \Rightarrow r_p + R_L = \frac{\mu R_L}{A} = \frac{50 R_L}{10} = 5R_L$

$\Rightarrow 4R_L = r_p \Rightarrow R_L = \dfrac{r_p}{4} = \dfrac{20}{4} = 5k\Omega$

14 **(c)**

Forward resistance

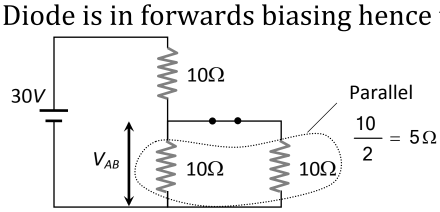
$= \dfrac{\Delta V}{\Delta I} = \dfrac{0.7-0.5}{1.0 \times 10^{-3}} = 200\Omega.$

15 **(b)**

$\beta = \dfrac{\alpha}{1-\alpha} = \dfrac{0.96}{1-0.96} = 24$

16 **(a)**

Diode is in forwards biasing hence the circuit can be redrawn as follows



$$V_{AB} = \frac{30}{(10+5)} \times 5 = 10\ V$$

17 **(c)**

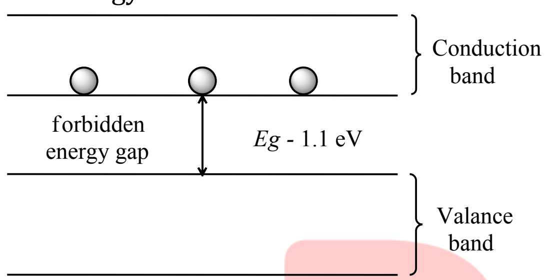
According to Richardson-Dushman equation, number of thermions emitted per sec per unit area $J = AT^2 e^{-W_0/kT} \Rightarrow J \propto T^2$

18 **(b)**

According to Pauli's exclusion principle, the electronic configuration of number of subshells existing in a shell and number of electrons entering each subshell is found. Hence, on the basis of Pauli's exclusion principle, the manifestation of band structure in solids can be explained.

20 **(a)**

The energy band scheme of semiconductors is shown here.



In semiconductors, valence band and conduction band are separated by an energy gap called the forbidden energy gap. It is very small. At room temperature some electrons in valence band acquire thermal energy. This energy is more than forbidden energy gap E_g, thus they jump into the conduction band and leaves their vacancy in the valence band which act as holes. Hence, at room temperature valence band is partially empty and conduction band is partially filled.

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	B	B	A	B	B	B	B	B	A	D
Q.	11	12	13	14	15	16	17	18	19	20
A.	C	B	B	C	B	A	C	B	B	A