Physicsaholics

DPP – 4 (Semiconductor)

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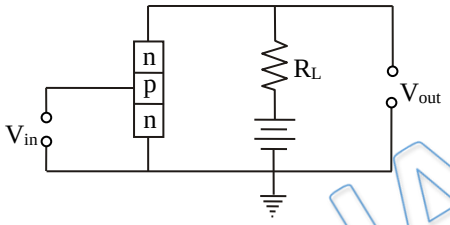
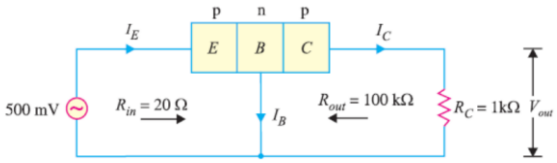
Q 1. An n-p-n transistor circuit is arranged as shown in fig. It is –



(a) a common-base amplifier circuit
(b) a common-emitter amplifier circuit
(c) a common-collector amplifier circuit
(d) none of the above

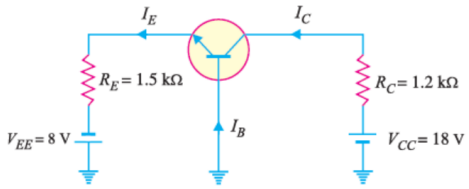
Q 2. A common base transistor amplifier has an input resistance of 20 Ω and output resistance of 100 kΩ. The collector load is 1 kΩ. If a signal of 500 mV is applied between emitter and base, find the voltage amplification. Assume α_{ac} to be nearly one.



(a) 25
(b) 50
(c) 75
(d) 100

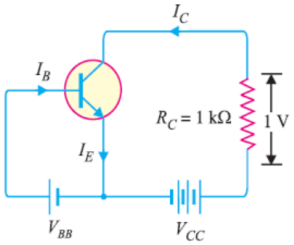
Q 3. In a common base connection, current amplification factor is 0.9. If the emitter current is 1mA, determine the value of base current.
(a) 0.1 mA
(b) 0.2 mA
(c) 0.4 mA
(d) 0.5 mA

Q 4. For the common base circuit shown in Figure, determine I_C and V_{CB} . Assume the transistor to be of silicon.



(a) 4.87 mA ,12.16 V
(b) 3.27 mA ,11.16 V
(c) 4.87 mA ,11.16 V
(d) 3.27 mA ,12.16 V

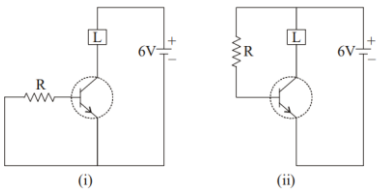
Q 5. For a transistor, $\beta = 45$ and voltage drop across 1kΩ which is connected in the collector circuit is 1 volt. Find the base current for common emitter connection.



(a) 0.022 mA
(b) 0.011 mA
(c) 0.033 mA
(d) 0.044 mA

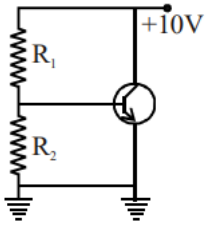
Q 6. A transistor is connected in common emitter (CE) configuration in which collector supply is 8 V and the voltage drop across resistance R_C connected in the collector circuit is 0.5 V. The value of $R_C = 800\ \Omega$. If $\alpha = 0.96$, determine base current
(a) 0.026 mA
(b) 0.011 mA
(c) 0.033 mA
(d) 0.044 mA

Q 7. Choose the correct option:



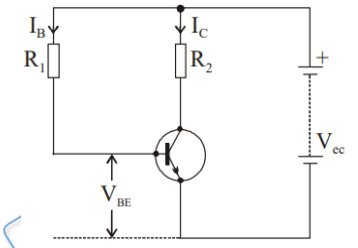
(a) In circuit 1 lamp does not glow but in circuit 2 lamp glows
(b) In circuit 1 as well as 2 lamp does not glow
(c) In circuit 1 lamp glows but in 2 lamp does not glow
(d) In both circuit lamp glows

Q 8. Figure shows an n-p-n transistor. Choose the correct statement out of the following :



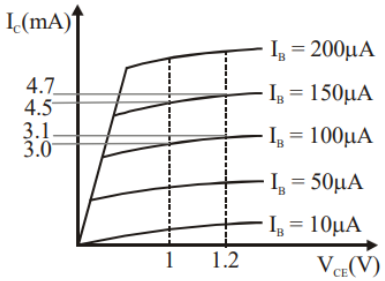
(a) Collector-base junction as well as emitter-base junction both are forward biased
(b) Collector-base junction as well as emitter-base junction both are reverse biased
(c) Collector-base junction is forward biased and emitter-base junction is reverse biased
(d) Collector-base junction is reverse-biased and emitter-base junction is forward biased

Q 9. In the junction transistor voltage amplifier circuit of figure, if R_1 = 100 k Ω, R_2 = 1kΩ, V_{ec} = 6.0 V and V_{BE} = 0.6 V, current gain = 60



(a) I_B = 54μA
(b) I_C = 3.24 mA
(c) the voltage across R_2 = 3.24 V
(d) the voltage across the collector-emitter = 3.24 V

Q 10. Output characteristic of n-p-n transistor in CE configuration is shown. From the characteristic curve determine the current gain at V_{CE} = 1 V –



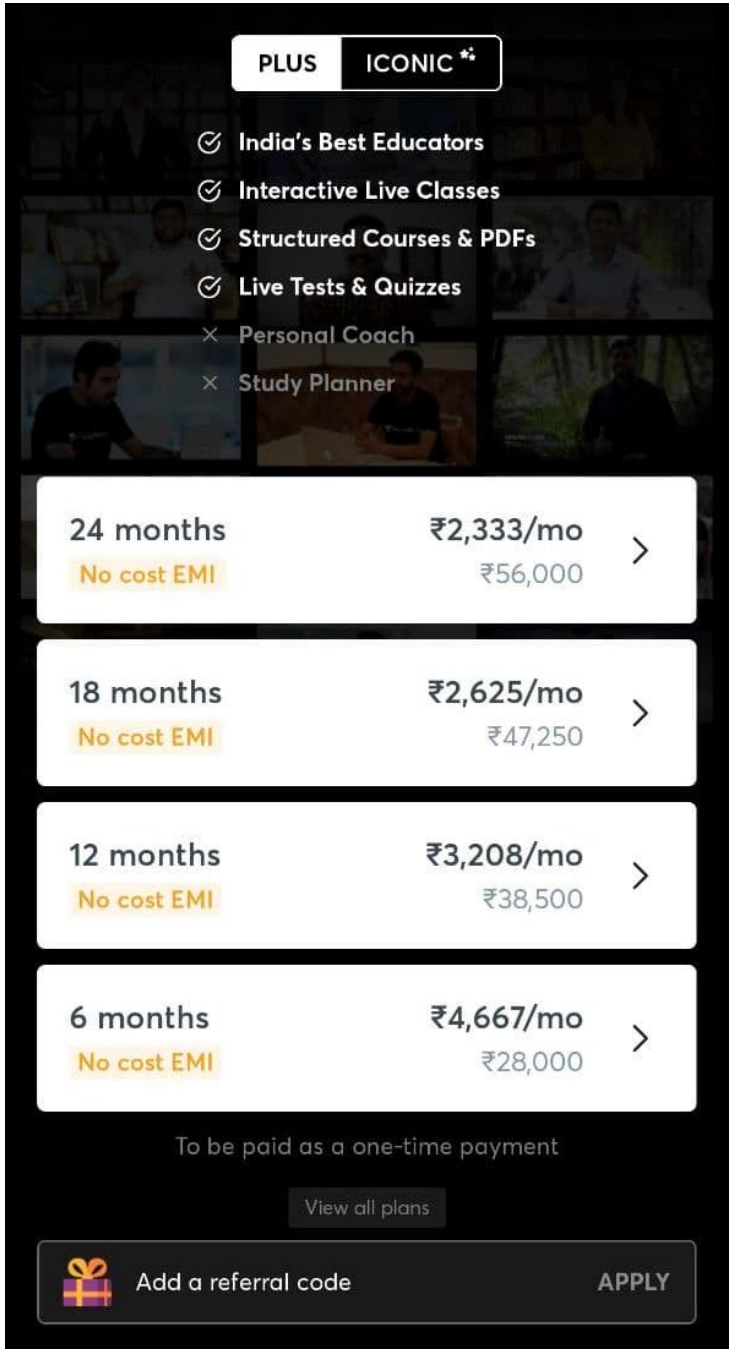
(a) 30
(b) 32
(c) 28
(d) 40

Q 11. A transistor is connected in common emitter configuration .The collector emitter voltage is 8V and load resistance of 800Ω is connected in the collector circuit. The voltage drop across the load resistance is 0.5V . If α be 0.96 , what is the base current
(a) 5 μA

(b) 8 μ A
(c) 9.6 μA
(d) 26 μ A

Answer Key

Q.1) b	**Q.2) b**	**Q.3) a**	**Q.4) a**	**Q.5) a**
Q.6) a	**Q.7) a**	**Q.8) d**	**Q.9) a,b,c**	**Q.10) a**
Q.11) d				



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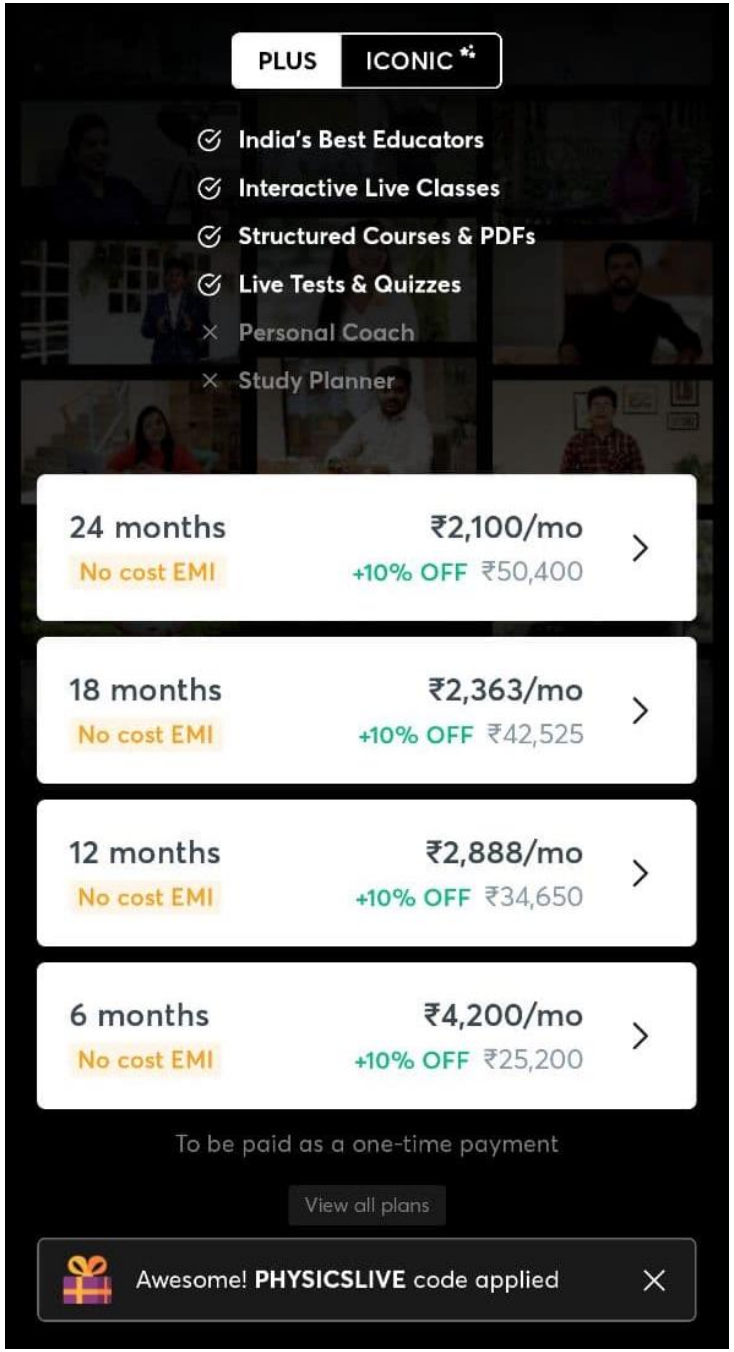


Written Solution

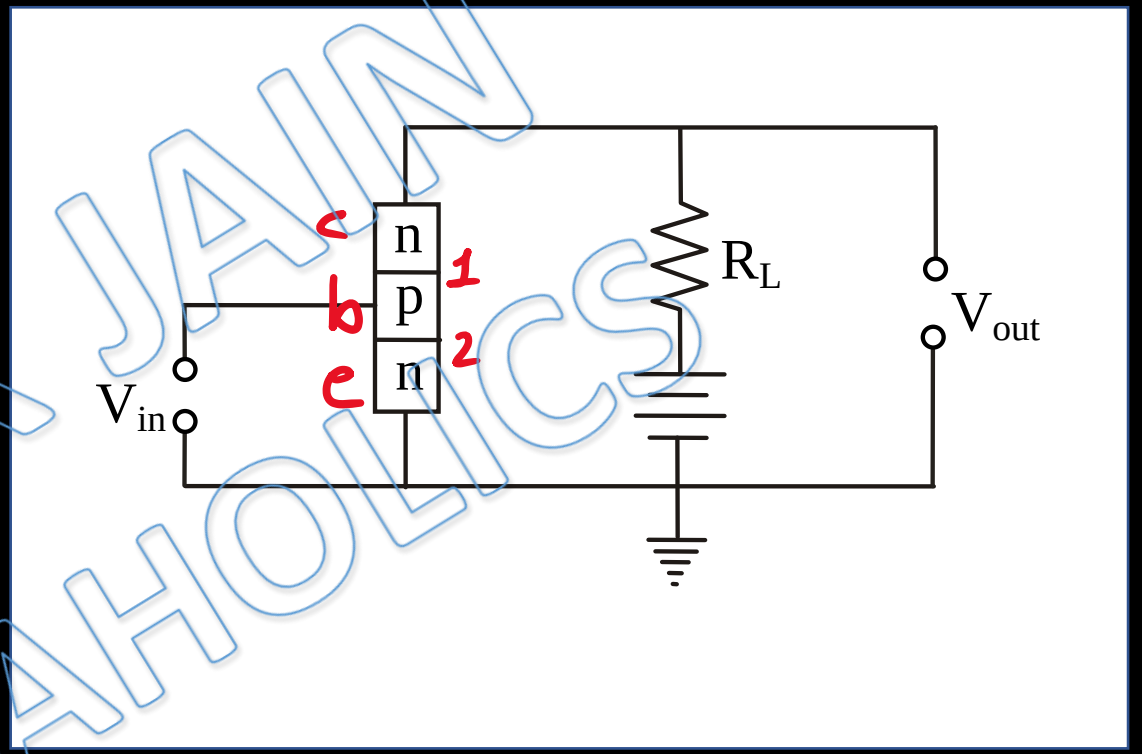
DPP- 4 , Semiconductor :Transistor

By Physicsaholics Team

Sol 1)

Junction 1 is reverse biased, hence upper n is collector & lower n is emitter.

Circuit is common emitter.



Ans (b)

Sol 2)

Input current, $I_E = \frac{\text{Signal}}{R_{in}} = \frac{500\ \text{mV}}{20\ \Omega} = 25\ \text{mA}$. Since α_{ac} is nearly 1, output current, $I_C = I_E = 25\ \text{mA}$.

Output voltage, $V_{out} = I_C R_C = 25\ \text{mA} \times 1\ \text{k}\Omega = 25\ \text{V}$

$\therefore$ Voltage amplification, $A_v = \frac{V_{out}}{\text{signal}} = \frac{25\ V}{500\ mV} = 50$

Ans. (b)

Sol 3) $\alpha = .9$, $I_e = 1\,mA$ $I_b = ?$

$$\frac{I_c}{I_e} = .9 \Rightarrow I_c = .9\, I_e = .9\,mA$$

$$I_b = I_e - I_c = 1\,mA - .9\,mA$$

$$I_b = .1\,mA$$

(Ans(a)

Sol 4) $V_{BE} = .7\,V$

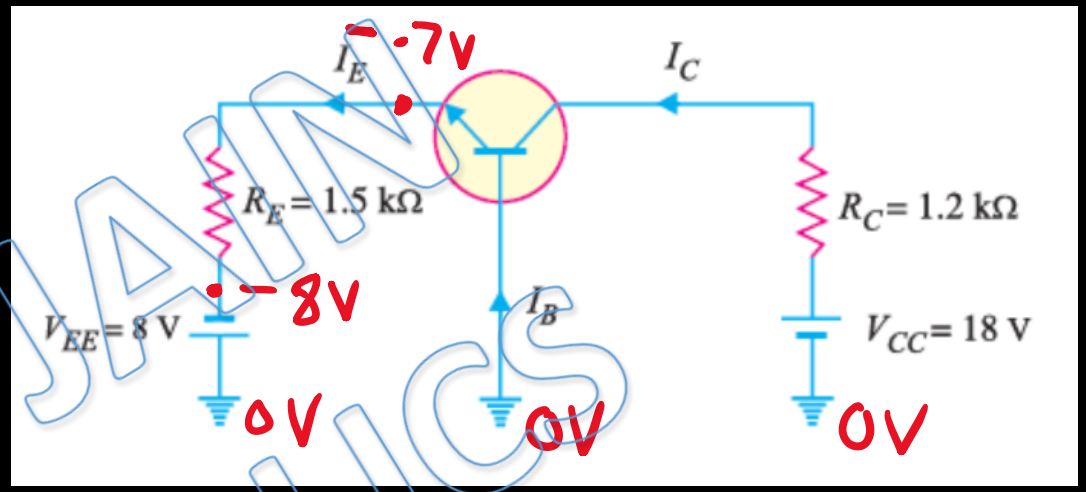
Voltage across $R_E = (8 - .7)\,V$

$$I_E = \frac{7.3}{1.5K} = 4.87\,mA$$

$$I_C \simeq I_E = 4.87\,mA$$

$$V_{BC} = V_{CC} - I_C R_C = 18 - 4.87m \times 1.2K$$

$$\simeq 12.16\,V$$



Ans (a)

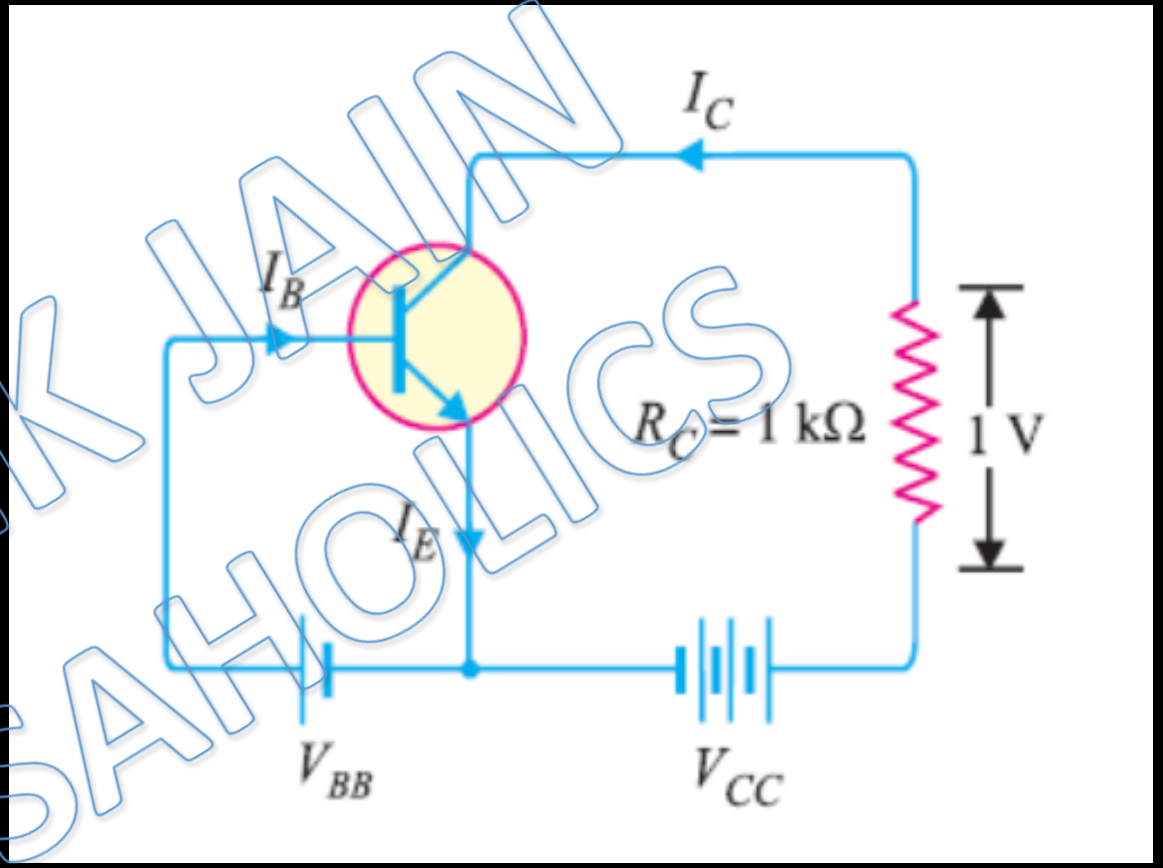
Sol 5) $I_B = ?$

$I_C = \frac{1}{1K} = 1mA$

$\beta = 45$

$I_B = \frac{I_C}{\beta} = \frac{1mA}{45}$

$= 0.022mA$



Ans (a)

Sol 6)

$R_c = 800\,\Omega$

Voltage across $R_c = 5\,V$

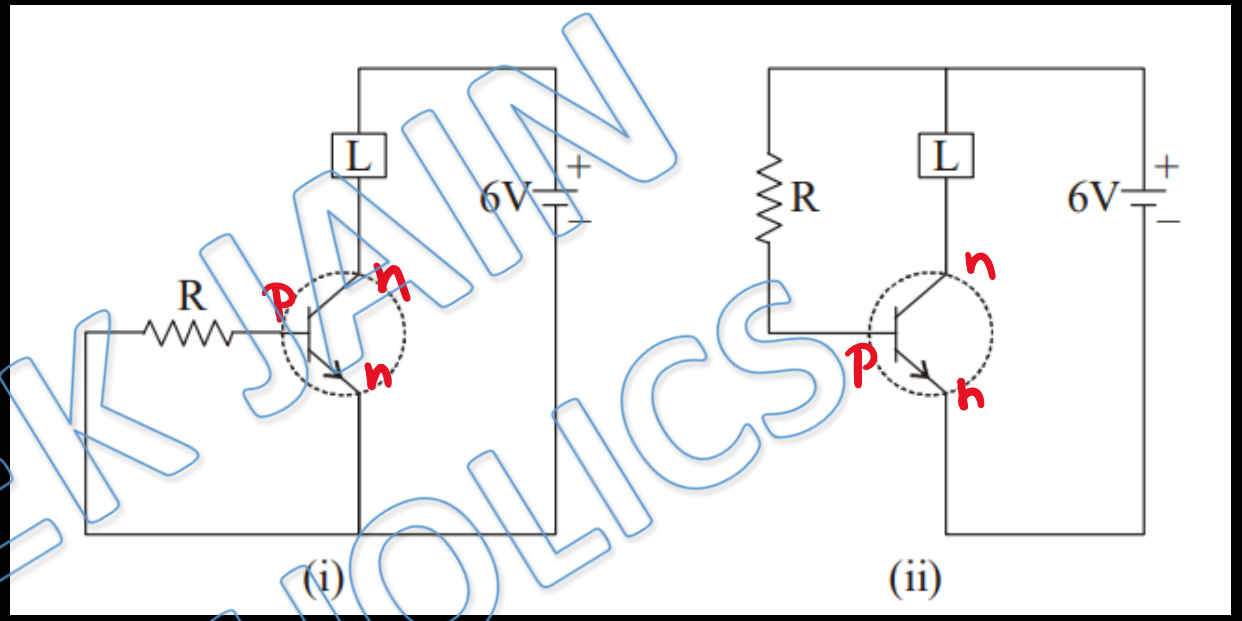
$I_c = \frac{5}{800} = \frac{5}{8}\,mA$

$\alpha = .96 \Rightarrow \beta = \frac{\alpha}{1-\alpha} = \frac{.96}{1-.96} = \frac{96}{4} = 24$

$I_B = \frac{I_c}{\beta} = \frac{5}{8\times 24}\,mA = .026\,mA$

Ans (a)

Sol 7)



In figure (i)

$V_{BE} = 0 \Rightarrow I_B = 0$

$\Rightarrow I_C \to 0$

$\Rightarrow$ Lamp will not glow.

In figure (ii)

Circuit is in active mode.

Lamp will glow.

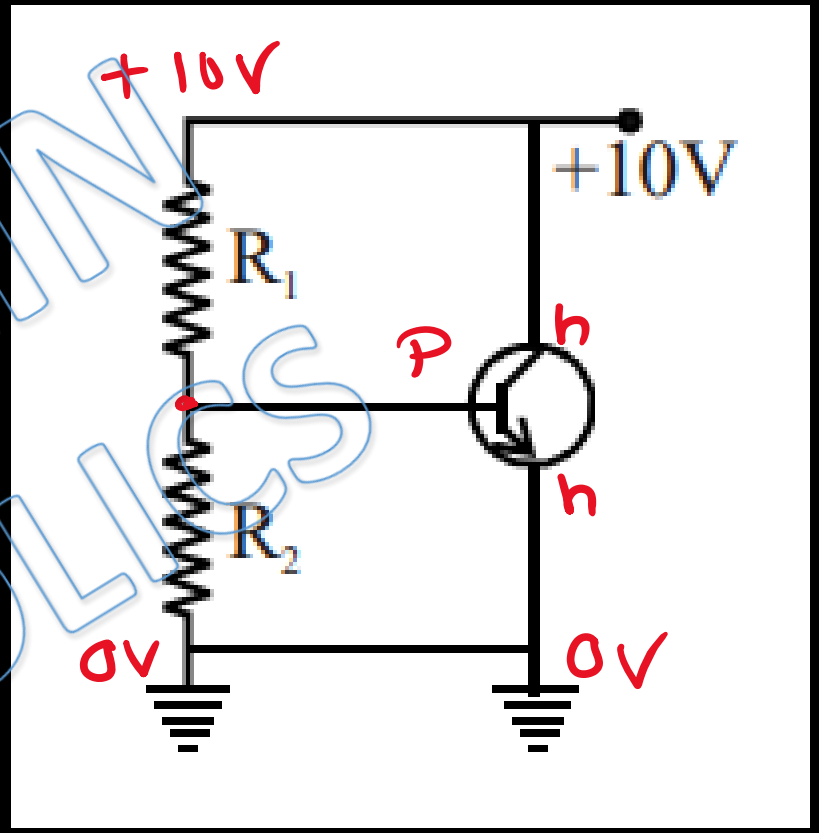
Ans(a)

Sol 8)

Potential of base is somewhere between 0V & 10V

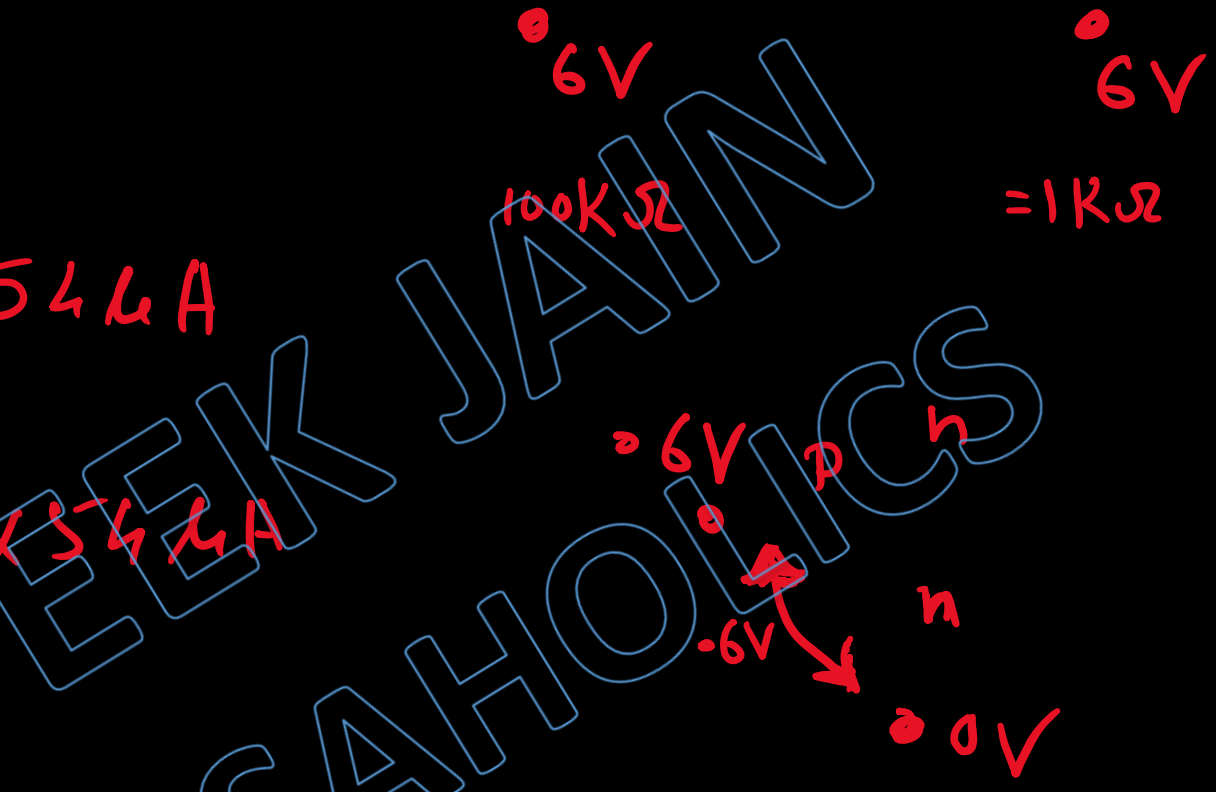
⇒ Base emitter junction is forward biased.

⇒ Collector base junction is reverse biased.



Ans (d)

Sol 9) $\beta = 60$



$$I_B = \frac{6 - .6}{100k} = 54\mu A$$

$$I_C = \beta I_B = 60 \times 54\mu A$$
$$= 3240\ \mu A$$
$$= 3.240\ mA$$

Voltage across $R_2 = I_C R_2 = 3.24 \times 1\ V$
$$= 3.24 V$$

Ans (a, b, c)

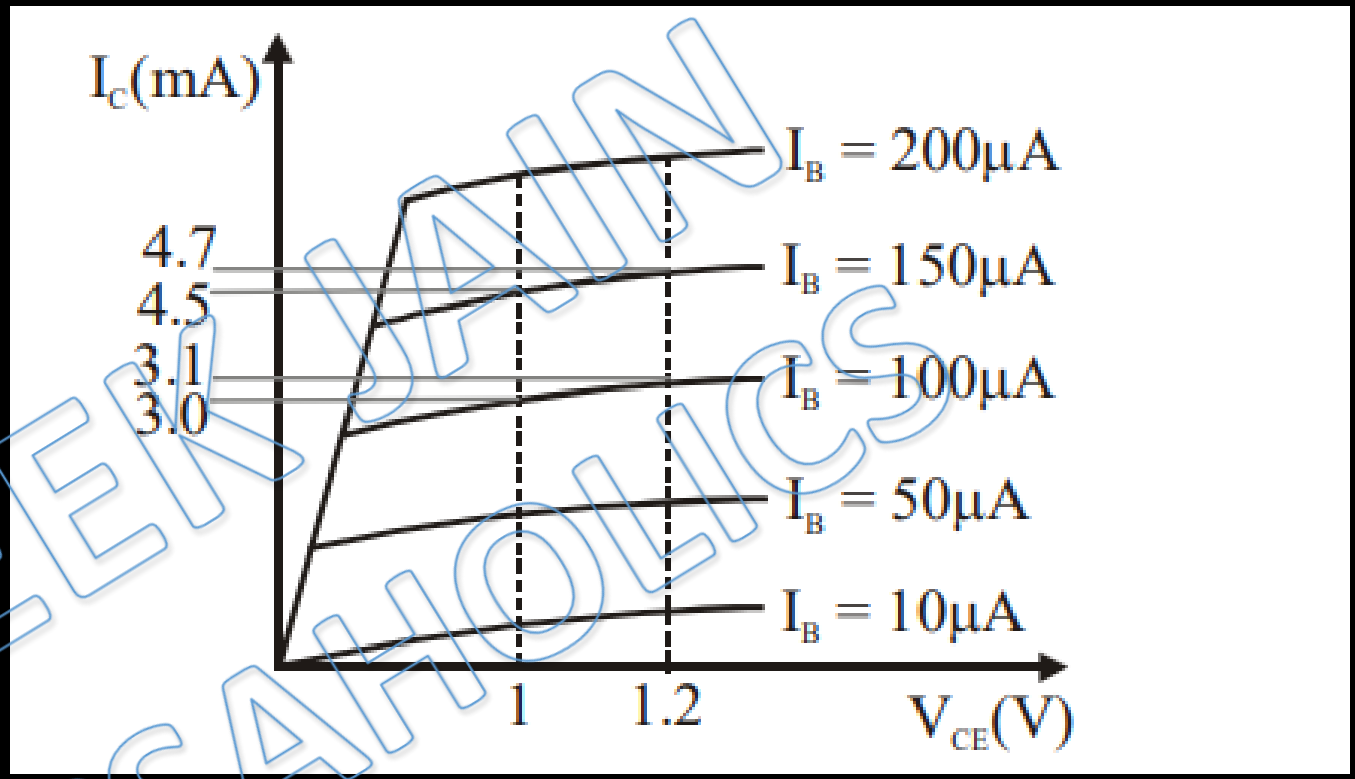
Sol 10)

Current gain at $V_{CE} = 1V$

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

$$= \frac{3mA}{100\mu A}$$

$$= \frac{3000}{100} = 30$$



Ans (a)

Sol 11)

$$V_{CE} = 8V, \quad R_L = 800\,\Omega$$

Voltage across $R_L = 5V$, $\alpha = 96$, $I_B = ?$

$$\beta = \frac{\alpha}{1-\alpha} = \frac{96}{04} = 24$$

$$I_C = \frac{5}{800} = \frac{5}{8}\,mA$$

$$I_B = \frac{I_C}{\beta} = \frac{5}{8\times 24}\,mA = \frac{5000}{8\times 24}\,\mu A$$

$$= 26\,\mu A$$

Ans(d)

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