Q15. How are infra red waves produced? Why are these referred to as 'heat waves'? Write their one important use.

Answer: Infra red waves are produced by

(1) Hot bodies and molecules.

(2) Laser

(3) In Globar as thermal light source where a Silicon carbide rod when electrically heated by to 1000 to 1650 ^{0}C emits infra red waves

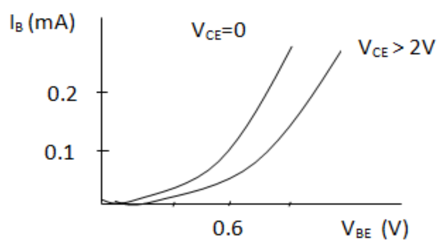
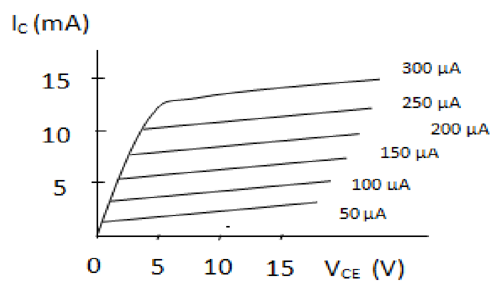
(4) Radiation from Sun

Since most of the thermal radiation emitted by objects near room temperature are Infra red hence referred as Heat Waves.

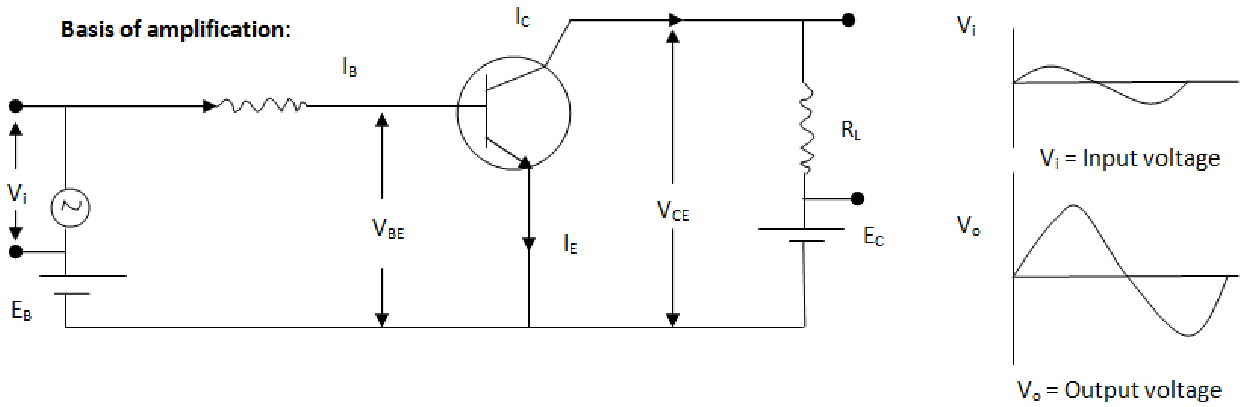
Use: In night-vision devices infrared illumination are used to see people or animals secretly.

Q16. Draw the transfer characteristic curve of a base biased transistor in CE configuration. Explain clearly how the active region of the V_o versus V_i curve in a transistor is used as an amplifier.

Answer:

 Input Characteristics	The input characteristics like forward biased p-n junction. If the biasing voltage is small as compared to the height of the potential barrier at the junction, the current I_B is very small. When voltage is more than the barrier height, the current rapidly increases. Here most of the electrons diffused across the junction go to the collector, the net base current is very small or the order of microamperes even at large values of V_{BE}
 Output Characteristics	In the output characteristics, for small values of collector voltage, the collector base junction is reverse biased as the base is more at positive potential. The current Ic is small. As the electrons are forced from emitter side, the collector current Ic is still large as compared to reverse biased p-n junction. As voltage Vc is increased, the current rapidly increases and becomes constant once the junction is forward biased. When base current increases ,collector current is high and increases rapidly in forward bias.

Basis of amplification:



Above circuit shows n-p-n transistor in common emitter mode. The battery E_B provides biasing voltage for base-emitter junction. V_{CE} voltage between collector and emitter maintained by using battery E_C.
The base emitter junction is forward biased and so the electrons of the emitter flow towards the base. As the base region is very thin (of the order of micrometer) and collector is also maintained at a positive potential, most of the electrons cross the base region and move into the collector.
The holes in the base region may diffuse into the emitter due to the forward biasing of the base-emitter junction. The electrons coming from the emitter may recombine with some of the holes in the base. If the holes are lost in this way, the base will become negatively charged and will obstruct the incoming electrons from the emitter. If the base current IB is increased by a small amount, the effect of the hole-diffusion and hole-electron recombination may be neutralised and the collector current will be increased. Thus a small change in the current IB in the base circuit controls the larger current Ic in the collector circuit. This is the **basis of amplification in transistor.**

The input signal to be amplified is connected in series with the biasing battery E_B in the circuit. A load resistor having a large resistance R_L is connected in the collector circuit, the output voltage is taken across resistor. As V_{BE} (base emitter voltage) changed, base current I_B changes, which results changes in collector current I_C, current gain $\beta = \Delta I_C/\Delta I_B$, voltage across $R_L = \Delta V = R_L \Delta I_C$