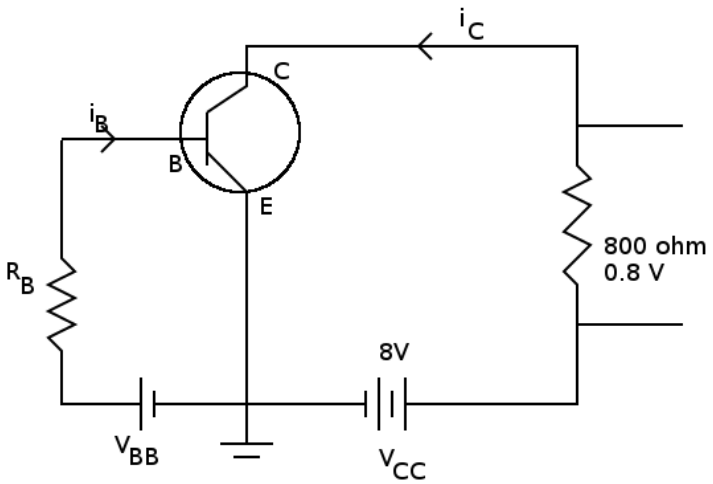
B.P.T.S. 08

Marks Distribution: Q1-5: 1, Q6-10: 2, Q11-15: 3, Q16: 5

1. What type of lens is ana air bubble inside water?
2. Prove that de Broglie wavelength of an electromagnetic radiation is equal to the wavelength of the photon?
3. Semiconductors are opaque to the visible light but transparent to infrared light. Why?
4. In a transistor circuit, the reverse bias is kept very high as compared to forward bias, why?
5. UV light is incident on two photosensitive materials having work functions W_1 and W_2 ($W_1 > W_2$). In which of the two cases, will K.E. Of emitted electron be greater? Why?
6. How the resolving power of astronomical telescope will change when
   1. frequency of light incident on objective lens is increased
   2. focal length of the objective lens is increased
   3. aperture of objective lens is halved?
7. Energy gaps is Ge, Si, and diamond are 0.7, 1.1, and 7eV respectively. Compare their conductivities at absolute zero and at room temperature.
8. An n-type semiconductor has large number of free electrons but still it is electrically neutral, why?
9. If the base resion of a transistor is made large as compared to the usual transistor, how does it affect
   1. collector current
   2. current gain of the transistor
10. A good quality mirror reflects about 80% of the visible light incident on it. How ill you find out whether 20% of the photons have not been reflected at all or all the photons have been reflected but energy of each has been reduced by 20%?
11. A small fish, 0.4m below the surface of lake, is viewed through a simple converging lens of focal length 3m. The lens is kept at 0.2m above the water surface such that fish lies on the optical axis of lens. Find the location of the image of the fish seen by observer. ($\mu_{water} = 4/3$)
12. When a beam of 10.6eV photons of intensity 2 Wm^{-2} falls on a platinum surface of area $10^{-4}m^2$ and work funciton 5.6eV, 0.53% of the incident photons eject photoelectrons. Find the number of photoelectrons emitted per second and their minimum and maximum energies (in eV).
13. If current amplification factor is 25, determine collector-emitter voltage and base current. If input resistance is 200 Ω, calculate voltage gain and power gain.
14. The image of a small electric blub fixed on a wall of a room is to be obtained on the opposite wall 3m away by means of convex lens. What is maximum focal length of required lens.
15. Light of wavelength ($\lambda = 2000$ Å) falls on aluminium surface (work function of Al is 4.2eV). Calculate
    1. the K.E. Of the fastest emitted photoelectrons
    2. cur-off wavelength for aluminium. ($h = 6.6 \times 10^{-34}$ Js)



16. Write and dervie a formula for a thin lens for the dependence of its focal length on refractive index and on radii of curvature. With the help of this formula show that focal length of a lens is increases when it is dipped in a liquid.