SENIOR SECTION

1. Threshold wavelength of certain material is 5000A°. Will photoelectric emission take place when the material is illuminated by UV lamp of power 8.3W?
   Yes, because λ of UV RAYS is less than 5000A°.

2. A source of light is placed at a distance r from a photoelectric cell. What would be the effect of doubling the distance r on i)photoelectric current ,ii) cutoff potential?
   Doubling the distance r will make the intensity ¼ th i) photoelectric current also becomes ¼ th

   ii) no change in cut off potential as it is independent of intensity.

3. An electron and a proton have same kinetic energy which of them will have greater deBroglie wave length?
   As the kE is same electron will have less momentum due to its less mass , so it will have greater deBroglie wavelength , as $\lambda = h/p$.

4. An electron and a proton have same momentum which of them will have greater deBroglie wave length?
   Both will have same deBroglie wave length, as $\lambda = h/p$.

5. The graph shows the variation of kinetic energy of photoelectron emitted with the frequency of incident radiation for two photosensitive materials A and B .Find which of them will have i) more threshold wavelength ii) more work function iii) electrons emitted with more kinetic energy for same incident radiation of suitable frequency and intensity ?
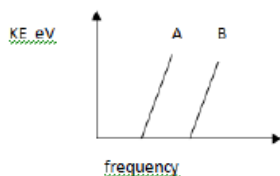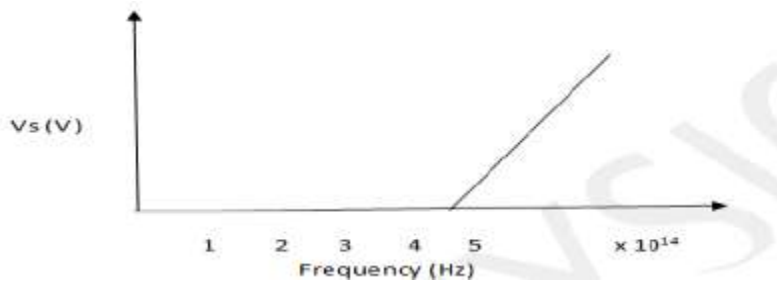

i) A   ii) B iii) A

6.Two metals A and B have work functions 2eV and 4eV respectively, which metal has lower threshold wavelength?
   B, since its work function and threshold frequency are more.

7. From the graph given below for sodium calculate the i) the threshold frequency ii) work function for sodium.

Take $h = 6.6 \times 10^{-34}$ Js

i) $\vartheta_0 = 4.5 \times 10^{14}$ Hz   ii) $W = h\vartheta_0/e = 1.85$ eV

X intercept is 4.5 X 10^{14}

8. An electromagnetic wave of wavelength λ is incident on a photosensitive surface of negligible work function. If the photo electrons emitted from the surface have the same deBroglie wavelength λ_B prove that

$$\lambda = \frac{2mC}{h}\lambda_B^2$$

$Ek = \frac{hC}{\lambda}$ (i) $\lambda_B = \frac{h}{\sqrt{2mEk}}$ $\lambda_B^2 = \frac{h2}{2mEk}$ (ii) sub   (i) in (ii) and simplifying $\lambda = \frac{2mC}{h}\lambda_B^2$

9. The radius of the first orbit of an electron in Hydrogen atom is $0.53 A^o$. What is the radius of second orbit?

$r_2 = 4r_1$, $r_2 = 4 \times 0.53 A^o = 2.12 A^o$.

10. Name the spectral series of Hydrogen in i)visible region ii) UV region

i) Balmer series ii) Lyman series

11. What is the physical meaning of negative energy of an electron?

The electron is bound to the atom.

12. How does n/p ratio of a nucleus change in β emissision?

In negatron emission n/p ratio decreases. n/p ratio increases in positron emission.

13. The half life of radium is 1600years. After how many years the remaining sample will be 25% of its initial amount?

$N/N_0 = (\frac{1}{2})^n$, where n is number of half lives here $N/N_0 = (\frac{1}{2})^2$ n= 2 ,

total time = n x half life = 2 x1600 = 3200 years

14. What type of spectrum is emitted by i) α particle ii) β particle ?

i) line spectrum ii) continuous spectrum.

15. Name a material which can be used as a moderator, coolant and neutron reflector.

heavy water (D_2O)

16. Name the most stable nuclei. Which among the following Lithium & plutonium may undergo nuclear i) fission ii) fusion?

i) Plutonium   ii) Lithium

17. Name any two quantities which are conserved in any Nuclear reaction.
    atomic number and mass number are conserved.

18. Which among the following U -238 , U-235 , Pu – 239 , U -233 undergo nuclear fission?
    U-235 , Pu – 239 , U -233

19. In which of the reaction, nuclear fission or nuclear fusion energy released per unit mass is greater?
    nuclear fusion .

20. Identify isotones among the following: $_2He^4$, $_2He^3$, $_6C^{14}$, $_7N^{14}$, $_8O^{15}$, $_8O^{16}$
    $_6C^{14}$, $_8O^{16}$

21. What is the ratio of nuclear densities of two nuclei A and B having mass numbers in the ratio 1:3?
    1: 1, Nuclear density is independent of mass number of the nuclei.

22. The ground state energy of electron in hydrogen atom is -13.6eV.Calculate the kinetic and
    potential energy of electron in this state .

$E_K = -E = 13.6eV$, $E_p = 2E = -27.2eV$

23. Define K factor or multiplication factor in nuclear fission reaction. What is its importance?
    It is the ratio of number of neutrons producing fission in a generation to the number of
    neutrons producing fission in previous generation.
    If K> 1 ,the reaction is super critical as in atom bomb . If K = 1, the reaction is critical, as in a
    nuclear reactor. If K< 1 the reaction is sub critical and the chain reaction may stop.

24. Mention uses of radio isotopes.
    Co-60 –used in the treatment of cancer, I -131 -- used in the treatment of thyroid gland,
    Na-24 – used to study about the functioning of heart, blockage in blood vessels, C-14- radio
    carbon dating ,to determine the age of fossils.

25. Which of the following radiations α ,β,Υ i) are similar to X-rays not defelected by electric and magnetic fields
ii) are easily absorbed by matter and has greatest ionizing power iii) similar to cathode rays , have medium
penetrating and ionizing power.
i) Υ rays ii) α rays iii) βrays

Solids & Semiconductor(Electronic)devices

1 .Which of the following Boron or Aluminium will be preferred for doping a Silicon crystal tomake it extrinsic
semiconductor? Name the type of semiconductor thus obtained.
Aluminium, as its size is comparable with silicon atom. P – type semiconductor as Al is trivalent impurity.

2. What is the similarity between zener diode and photodiode. Mention one use for each of them.
    Both work under reverse bias. Zener diode is used as a voltage regulator. Photo diode can be used
    in burglar alarms, Fire alarms, Automatic opening and closing of doors at the shopping malls.

3. Name two factors on which electrical conductivity of a pure semiconductor at a given temperature depends.
    i) the width of forbidden band or energy gap ii) intrinsic charge concentration

4. What is the ratio of n_e to n_h in i) intrinsic ii) P- type iii) N – type semiconductors?

 i) $n_{e/}n_h = 1$ ii) $n_{e/}n_h < 1$ iii) $n_{e/}n_h > 1$

5. Mention advantages of LEDs over incandescent lamps.

i) Low operational voltage ii) long life iii) No warm up time is needed, so fast action.

6.
Explain why elemental semi conductors cannot be used to make LED's emitting visible light?
 Band gap of elemental semi conductors is in the infra red region therefore they cannot emit visible light.

7.
Name the type of diode whose characteristics are shown in the following figures. Mention their uses.
In figure (i) Name the terms the points along X and Y axes which are indicated by the two slanting arrows .

(i)   (ii)   (iii)
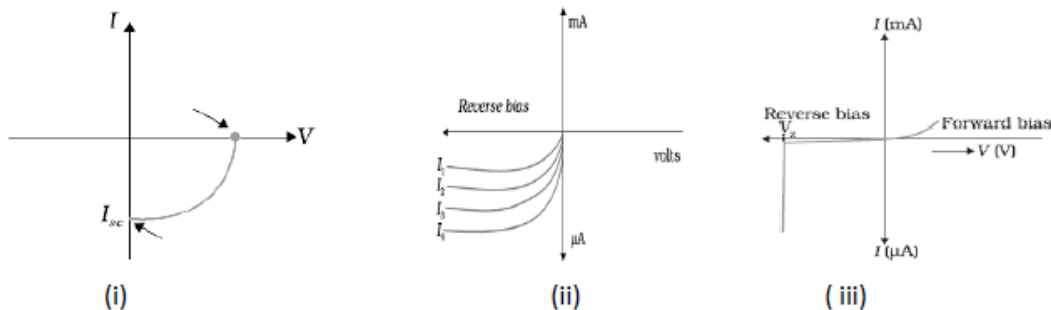
i) solar cell , used to power watches calculator, to make solar panel . point on X-axis pointed by the arrow gives open circuit voltage , point on Y-axis pointed by the arrow gives short circuit current
ii) Photo diode used to detect optical signals iii) zener diode used to regulate voltage

8.
Three photo diodes D1,D2 and D3 are made up of semi condoctors having band gaps of 2.5eV ,2 eV and 3eV
Respectively .Which of them will be able to detect light of wavelength 6000A°?

Energy of incident photon is $E = \dfrac{hC}{\lambda}$ $= \dfrac{6.6\,x10{-}34\,Js\ x\ 3\,x108\ m/s}{6x\ 10{-}7\,x\ 1.6\,x10{-}19} = 2.06$ eV

 For the detection of optical signal the energy of incident radiation must be greater than the band gap
It is true only for D2 .Only D2 can detect the radiation.

9. What is minority carrier injection in forward bias?

   In forward bias electrons from N side are attracted to P side where electrons are minority carriers it is known as Minority carrier injection.

10. Why a photodiode is always operated under reverse bias.

The change in reverse bias current with change in intensity of incident radiation is appreciable ,so the optical signals can be detected easily.

11.Even though energy gap in GaAs is more than that in Si , GaAs is preferred to Si for making solar cells ,why ?

GaAs has more light absorption coefficient than Si.

12. What is an ideal diode ?

A diode which has almost zero resistance during forward bias and infinite resistance during reverse bias.

13. Name the two processes taking place when a PN junction diode is fabricated ? What are its consequences?

 Diffusion of majority carriers to opposite side. Combination and neutralization of of majority carriers at the junction.

Consequences

Formation of depletion layer and internal potential barrier.