PHYSICS

BOOKS - SAI PHYSICS (TELUGU ENGLISH)

DUAL NATURE OF RADIATION AND MATTER

Mcqs

1. The ratio of energies of emtiied radiation by a black body at 600 K and 900 K when the surrounding temperature is 300, is

A. $\dfrac{5}{16}$

B. $\dfrac{7}{16}$

C. $\dfrac{3}{16}$

D. $\dfrac{9}{16}$

Answer: C

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2. Initially a photon of wavelength λ_1 falls on the photocathode and emits of maximum energy E_1. If the wavelength of the incident photon is changed to λ_2 the maximum energy of the electron emitted becomes E_2. Then value of he (h=Planck's constant,c= velocity of light) is

A. $hc = \dfrac{(E_1 + E_2)(\lambda_1\lambda_2)}{\lambda_2 - \lambda_2}$

B. $hc = \dfrac{E_1 - E_2}{\lambda_2\lambda_1}, (\lambda_1\lambda_2)$

C. $hc = \dfrac{(E_1 - E_2)(\lambda_2 \lambda_1)}{\lambda_1 \lambda_2}$

D. $hc = \dfrac{\lambda_2 - \lambda_1}{\lambda_1 \lambda_2} E1$

Answer: B

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3. Two photons of energy 2.5 eV and 3.5 eV fall on a metal surface on work function 1.5 eV. The ratio of the maxium velocities of the photoelectrons emitted from the metal surface is

A. $1 : 4$

B. $2 : 1$

C. $1 : 2$

D. $1:\sqrt{2}$

Answer: D

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4. Photoelectric emission is observed from a metallic surface for frequencies v_1 and v_2 of the incident light $(v_1 > v_2)$. If the maximum values of kinetic energy of the photoelectrons emitted in the two cases are in the ratio $1:n$, then the threshold frequency of the metallic surface is

A. $\dfrac{v_1 - v_2}{(n-1)}$

B. $\dfrac{nv_1 - v_2}{(n-1)}$

C. $\dfrac{nv_2 - v_1}{(n - 1)}$

D. $\dfrac{v_1 - v_2}{(n - 1)}$

Answer: B

5. A photon of energy E ejects a photoelectron from a metal surface whose work function is W_0 .If this electon entres into a uniform magnetic field of induction B in a direction perpendicular to the field and describe a circular path of radius r, then the radius r is given by ,(in the usual notation)

A. $\dfrac{\sqrt{2m(E - W_0)}}{eB}$

B. $\sqrt{2m(E - W_0)eB}$

C. $\dfrac{\sqrt{2e(E - W_0)}}{mB}$

D. $\dfrac{\sqrt{2m(E - W_0)}}{eB}$

Answer: D

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6. X-rays of wavelength 0.14.nm are scattered from a block of carbon .What will be the wavelength of X-rays sacatted at $90°$?

A. 0.140 nm

B. 0.142 nm

C. 0.144 nm

D. 0.146 nm

Answer: B

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7. An X- ray tube produces a continuous spectrum of raditation with its shortest wavelength of 45×10^{-2}A. The maximum energy of a photon in the radiation of in eV is $\left(h = 6.62 \times 10^{-34}J - s, c = 3 \times 10^8 ms^{-1}\right)$

A. 27500

B. 22500

C. 17500

D. 12500

Answer: A

8. The work function of the nickel is 5 eV. When a light of wavelength 2000 Å falls on it ,it emits photoelectrons in the circuit .Then, the potential difference necessary to stop the faster electrons emitted is (Given , $h = 6.67 \times 10^{-34} J - s$)

A. 1.0V

B. 1.75V

C. 1.5V

D. 0.75V

Answer: C

9. In an experiment on photoelectric emission from a metallic surface ,wavelength of incident light 2×10^{-7} m and stopping potential is 2.5V .The threshold frequency of the metal (in Hz) approximately

(Charge of electrons $e = 1.6 \times 10^{-19}$C, Planck's constant , $h = 6.6 \times 10^{-34} J - s$)

    A. 12×10^{15}

    B. 9×10^{15}

    C. 9×10^{14}

    D. 12×10^{13}

Answer: C

10. An oil drop having a mass 4.8×10^{-18}g and a charge 2.4×10^{-18}C stands still between two charged horizontal plates separated by a distance of 1 cm If now the polarity of the plates is changed, instantaneous accleration of the drop is $(g = 10ms^{-2}$

A. $5ms^{-2}$

B. $10ms^{-2}$

C. $15ms^{-2}$

D. $20ms^{-2}$

Answer: B

11. According to Moseley's law , the frequency (v) of the K_a line and the atomic number Z of the element have the relation (A and B are constants)

A. $\dfrac{(v)}{(Z - A)} = B$

B. $\dfrac{\sqrt{v}}{(Z - A)} = B$

C. v(Z-A)=B

D. $v(Z - A)^2 = B$

Answer: B

12. $\Delta\lambda$ is the difference between the wavelength of K_α line and the minimum wavelength of the continuous X-rays spectrum when the X-ray tube is operated at a voltage V. If the operating voltage is changed to $\dfrac{V}{3}$, the above difference is $\Delta\lambda$ Then,

A. $\Delta\lambda' = 5\Delta\lambda$

B. $\Delta\lambda' = 4\Delta\lambda$

C. $\Delta\lambda' = 3\Delta\lambda$

D. $\Delta\lambda' > 3\Delta\lambda$

Answer: C

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13. Electrons ejected from the surface oa a metal ,when light of certain frequency is incident on it ,are stoppeed fully by a retarding potenital of 3V. Photoelectric effect in this metallic surface begins at a frequency $6 \times 10^{14} s^{-1}$ .The frequency of the incident light in s^{-1} is [Planck's constant $= 6.4 \times 10^{-34}$ Js, charge on the electron $= 1.6 \times 10^{-19} C$]

A. 7.5×10^{13}

B. 13.5×10^{13}

C. 13.5×10^{14}

D. 7.5×10^{13}

Answer: C

14. Match the paris in two column given below .

A. 1-ii,2-v,3-iv

B. 1-vi,2-v,3-iii

C. 1-ii,2-v,3-iv

D. 1-vi,2-v,3-iii

Answer:

15. Consider the two following A and B and identify the correct choice given in the answers.

A In the photovoltaic cells the photoelectric current produced is not proportional to the intensity of incident light .

B In gas filled photoemissive cells ,the velocity of photoelectrons depends on the wavelength of the incident radiation.

    A. Both A and B are true

    B. Both A and B are false

    C. A is true but B is false

    D. a is false but B is true

Answer: D

16. When radiation of the wavelength λ is incident on a metallic surface ,the stopping potential is 4.8 V. If the same surface is illuminated with radiation of double the wavelength ,then the stopping potential becomes 1.6 V.Then the threshold wavelength for the surface is

A. 2λ

B. 4λ

C. 6λ

D. 8λ

Answer: B

17. Two photons of energies twice and thrice the work function of a metal are incident on the metal surface .Then, the ratio of maximum velocities of the photoelectrons emitted in the two cases respectively ,is

A. $\sqrt{2}:1$

B. $\sqrt{3}:3$

C. $\sqrt{3}:\sqrt{2}$

D. $1:\sqrt{2}$

Answer: D

18. In the compton scattering process, the incident X-radiation is scattered at an angle $60°$.The wavelenght of scattered radiation is 0.22 Á.The wavelength of the incident X-radiation inÁ units

    A. 0.508

    B. 0.408

    C. 0.232

    D. 0.208

Answer: D

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19. If λ_0 is the De-Broglie wavelength for a proton accelerated through a potential difference of 100 V, De-Broglie wavelength for prop- particle accelerated through the same potential difference is

A. $2\sqrt{2\lambda_0}$

B. $\dfrac{\lambda 0}{2}$

C. $\dfrac{\lambda 0}{2\sqrt{2}}$

D. $\dfrac{\lambda 0}{\sqrt{2}}$

Answer: C

20. Photoelectric emission is observed from a metallic surface for frequencies v_1 and v_2 of the incident light rays $(v_1 > v_2)$. If the maximum value of kinetic energy of the photoelectrons emitted in the two cases are in the ratio `1:k, then the threshold frequency of the metallic surface is

A. $\dfrac{v_2 - v_1}{k - 1}$

B. $\dfrac{kv_1 - v_2}{k - 1}$

C. $\dfrac{kv_2 - v_1}{k - 1}$

D. $\dfrac{v_2 - v_1}{k}$

Answer: B

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21. The De- Broglie wavelength of an electron having 80eV energy is nearly

$$(1ev = 1.6 \times 106(-19)J)$$

Mass of the electron $= 9 \times 10^{-31} kg$Planck 's constant $= 6.6 \times 10^{-34} J - s$

    A. 140Å

    B. 0.14Å

    C. 14Å

    D. 1.4Å

Answer: D

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22. Consider the following statements A and B and indetify the corrent choice in the given answers.

A Thigtly bound electrons of target material scatter X-rays photon ,resulting in the Compton effect.

B Photoelectric effect takes place in free electrons

    A. Both A and B are true

    B. A is true but B is false

    C. A is false but B is true

    D. Both A and B are fasle

Answer: A

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23. The X-ray wavelength of L_a line of platinum (Z=78) is 1:30 Å.The X-ray wavelength of L_a line of Molybdeum (Z=42) is

A. 5.41Å

B. 4.59Å

C. 2.70Å

D. 1.35Å

Answer: B

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24. When a metal surface is illuminated by a light of wavelength 400nm and 250 nm . The maximum velocites of

the photo electrons ejected are v and 2v respectively. The work function of the metal is (h= Planck's constant e= Velocity of light in air

A. $2he \times 10^6 J$

B. $1.5he \times 10^6 J$

C. $hc \times 10^6 J$

D. $0.5hc \times 10^6$

Answer: A

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25. The energy of an X-ray photon of wavelength 1.65Å is $\left(h = 6.6 \times 10^{-34} Js, c = 3 \times 10^4 ms^{-1}, ev = 1.6 \times 10^{-19} J\right)$

A. 3.5keV

B. 5.5keV

C. 7.5keV

D. 9.5keV

Answer: C

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26. In a photoelectric experiment ,the maximum velocity of

photoelectrons emitted

A. Depends on intensity of incident radiation

B. Does not depend on the cathod material

C. Depends on frequency of incident radiation

D. Does not depend on wavelength of the incident radiation

Answer: C

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27. The photoelectric work function of a metal surface is 2eV.When light of frequency 1.5×10^{15} Hz is incident on it, the maximum kinetic energy energy of the photo electrons ,approximately is

A. 8eV

B. 6eV

C. 2eV

D. 4eV

Answer: D

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28. An the electron undeflected when passing perpen to mutually perpendicular electric and magnetic fields magnetic field is 8 Gauss and the electric field $Vm^{-1}$the velocity of the electron is

A. $2 \times 10^6 ms^{-1}$

B. $5 \times 10^5 ms^{-(1)}$

C. $6 \times 10^6 ms^{-1}$

D. $6 \times 10^5 ms^{-1}$

Answer: B

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29. An electron beam is allowed to pass normally through megnetic and electric fields which are mutually perpendicular. When the magnetic filed inductionand electric field strength are $0.0004 Wbm^{-2}$ and $3000 Vm^{-1}$ respectively the beam suffers no deflection .Then the velocity of electron is

A. $7.5 \times 10^6 ms^{-1}$

B. $7.5 \times 10^4 ms^{-1}$

C. $7.5 \times 10^2 ms^{-1}$

D. $1.2 \times 10^6 ms^{-1}$

Answer: A

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30. In a photoelectric phenomenon, the number of photoelectrons emitted on

A. The intensity of incident radiation

B. The frequency of the incident radiation

C. The velocity of incident radiation

D. The work function of the photo cathode

Answer: A

31. According to the Moseley's law, the frequency of a spectral line in X-ray spectrum varies as.

    A. Atomic number of the element

    B. Square of atomic number of the element

    C. Square root of atomic number of the element

    D. Fourth power of atomic number of the element

Answer: B

32. The photoelectric work function for a metal surface is 4.125eV. The cut -off wavelength for this surface is

   A. 4125Å

   B. 2062.5Å

   C. 3000Å

   D. 6000Å

Answer: C

33. The threshold wavelength for a certain metal is 2000 Å. The work function of the is

A. 6.2J

B. 6.2eV

C. 6.2MeV

D. 6.2keV

Answer: B

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34. X-rays are a stream of

A. Electrons

B. Phonons

C. Photons

D. Protons

Answer: C

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35. A beam of charged particles of charge q and a mass m are accelerated from rest through a potential difference of 100V. They pass through crossed electric and magnetic fileds which together produce null deflection .If these electronic and magnetic fields are respectively $15 \times 10^3 V m^{-1}$ and $5 W b m^{-2}$,then q/m has a value, in $C k g^{-1}$,equal to

A. 9×10^4

B. 15

C. 4.5×10^4

D. 4.5×10^4

Answer: C

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36. Photon of energy 2.0 eV and wavelength λfall on a metal plate and release photoelectrons with a maximum velocity v. By decreasing λby25% the maximum velocity of photoelectrons is doubled .The work function of the material of the metal plate in eV is

A. 2.22

B. 1.985

C. 2.35

D. 1.8

Answer: D

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37. Photoelectric current can be increased by using

A. Higher frequency radiation

B. Higher intensity radiation

C. Higher work function of metal plates

D. None of the above

Answer: B

38. The speed of electrons in a cathode ray beam ,which remains undeflected ,in Thomas experiment ,under the simultaneously action of a magnetic field $2 \times 10^{-3} Wbm^{-2}$ and the of an electric field $3.4 \times 10^4 Vm^{-1}$ is

A. $1.7 \times 10^7 ms^{-1}$

B. $2.8 \times 10^7 ms^{-1}$

C. $1.2 \times 10^6 ms^{-1}$

D. $5.4 \times 10^6 ms^{-1}$

Answer: A

39. If Planck's constant is given as $6.4 \times 10^{-34} J$ and electron charge is $1.6 \times 10^{-19} C$, the maximum wavelength of X-ray emitted ,when a 10keV electron is completely stopped by a target is

A. 6.2Å

B. 3.4Å

C. 1.8Å

D. 1.2Å

Answer: D

40. Emission of electrons in photoelectric effect is possible

if

    A. Metal surface is lightly polished

    B. The incident light is of sufficently high intensity

    C. The light is incident at right angles to surface of the

       metal

    D. The incident light is of suffciently low wavelength

Answer: D

41. A force is experienced by cathode rays when they pass through uniform electric field

    A. In the direction of electric filed

    B. In the direction opposite to that of electric field

    C. Perpendicular to electric field

    D. Zero ,because the cathode rays do not have the charge.

Answer: B

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42. Photoelectrons are emitted from a metal surface when photons of energy 3.1eV or more impinge on it .In an experiment with this metal using a monochromatic radiation the stopping potenital was found to be 2.5V. The energy of the photons used in the experment is

    A. 7.8eV

    B. 6.2eV

    C. 5.6eV

    D. 4.2eV

Answer: C

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43. Light of frequeny 1.5 times the threshold frequency , imcident on a photo sensitive material .If the frequency of incident light is halved and the intensity is doubled the photo current becomes

A. One-fourth

B. Doubled

C. Halved

D. Zero

Answer: D

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44. In photoelectric the slope of the straight line graph between stopping potential and frequency of incident radiation gives the ratio of Plancks constant to

    A. Velocity of light

    B. Mass of electron

    C. Charge of electron

    D. Intensity of photon

Answer: C

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