PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

DUAL NATURE OF MATTER AND RADIATION

Physics

1. A particle of mass $1mg$ has the same wavelength as an electron moving with a

velocity of $3 \times 10^6 ms^{-1}$. The velocity of the particle is

A. $2.7 \times 10^{-18} ms^{-1}$

B. $9 \times 10^{-2} ms^{-1}$

C. $3 \times 10^{-31} ms^{-1}$

D. $2.7 \times 10^{-21} ms^{-1}$

Answer:

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2. An electron of mass m and a photon have same energy E. The ratio of de - Broglie wavelengths associated with them is :

A. $\frac{1}{c}\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

B. $\left(\frac{E}{2m}\right)^{\frac{1}{2}}$

C. $c(2mE)^{\frac{1}{2}}$

D. $\frac{1}{c}\left(\frac{2m}{E}\right)^{\frac{1}{2}}$

Answer:

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3. All electrons ejected from a surface by incident light of wavelength 200nm can be stopped before traveling 1m in the direction of a uniform electric field of $4NC^{-1}$. The work function of the surface is

A. 4 eV

B. 6.2 eV

C. 2 eV

D. 2.2 eV

Answer:

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4. The maximum kinetic energy of the electrons hitting a target so as to produce X-ray of wavelength 1 Å is

A. 1.24 keV

B. 12.4 keV

C. 124 keV

D. None of these

Answer:

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5. An X-ray tube is operated at 15 kV. Calculate the upper limit of the speed of the electrons striking the target.

A. $7.26 \times 10^7 m/s$

B. $7.62 \times 10^9 m/s$

C. $7.62 \times 10^7 cm/s$

D. $7.26 \times 10^9 m/s$

Answer:

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6. A and B are two metals with threshold frequencies $1.8 \times 10^{14} Hz$ and $2.2 \times 10^{14} Hz$. Two identical photons of energy of 0.825 eV each are incident on them. Then photoelectrons are emitted in take $h = 6.6 \times 10^{-34} J/s$

A. B alone

B. A alone

C. neither A nor B

D. both A and B

Answer:

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7. If E_1, E_2 and E_3 represent respectively the kinetic energies of an electron, an $\alpha - partic \leq$ and a proton each having same de-Broglie wavelength, then

A. $E_1 > E_3 > E_2$

B. $E_2 > E_3 > E_1$

C. $E_1 > E_2 > E_3$

D. $E_1 = E_2 = E_3$

Answer:

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8. Which of the following when falls on a metal will emit photoelectrons ?

A. UV radiations

B. Infrared radiation

C. Radio waves

D. Microwaves

Answer:

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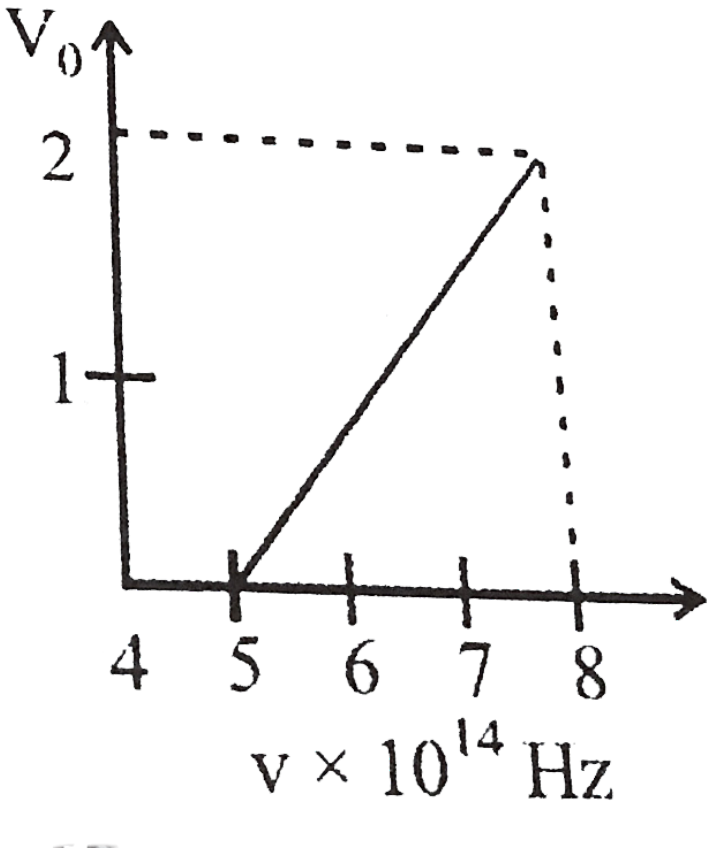
9. The stopping potential (V_0) versus frequency (v) plot of a substance is shown in

figure, the threshold wavelength is



A. $5 \times 10^{14} m$

B. 6000 Å

C. 5000 Å

D. cannot be estimated from given data

Answer:

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10. A material particle with a rest mass m_o is moving with a velocity of light c. Then, the wavelength of the de Broglie wave associated with it is

A. $\frac{h}{m_0 c}$

B. $\frac{m_0 c}{h}$

C. zero

D. ∞

Answer:

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11. A modern 200 W sodium street lamp emits yellow light of wavelength 0.6 μm. Assuming it to be 25% efficient in converting electrical

energy to light, the number of photons of yellow light it emits per second is

A. 1.5×10^{20}

B. 6×10^{18}

C. 62×10^{20}

D. 3×10^{19}

Answer:

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12. A proton has kinetic energy E = 100 keV which is equal to that of a photon. The wavelength of photon is λ_2 and that of proton is λ_1. The ratio of λ_2 / λ_1 is proportional to

A. E^2

B. $E^{1/2}$

C. E^{-1}

D. $E^{-1/2}$

Answer:

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13. In photoelectric effect the work function of a metal is 3.5 eV. The emitted electrons can be stopped by applying a potential of –1.2 V. Then

A. the energy of the incident photon is 4.7 eV

B. the energy of the incident photon is 2.3 eV

C. if higher frequency photon be used, the photoelectric current will rise

D. when the energy of photon is 3.5 eV, the photoelectric current will be maximum

Answer:

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14. The threshold frequency for a metallic surface corresponds to an energy of $6.2eV$ and the stopping potential for a radiation incident on this surface is $5V$. The incident radiation lies in

A. ultra-violet region

B. infra-red region

C. visible region

D. X-ray region

Answer:

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15. When photons of energy hv fall on an aluminium plate (of work function E_0), photoelectrons of maximum kinetic energy K

are ejected . If the frequency of the radiation is doubled , the maximum kinetic energy of the ejected photoelectrons will be

A. 2K

B. K

C. K+hv

D. $K + E_0$

Answer:

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16. The work functions for sodium and copper are $2eV$ and $4eV$. Which of them is suitable for a photocell with 4000Å light ?

A. Sodium

B. Copper

C. Both

D. None of these

Answer:

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17. The maximum velocity of an electron emitted by light of wavelength λ incident on the surface of a metal of work function ϕ, is Where h = Planck's constant , m = mass of electron and c = speed of light.

A. $\sqrt{\frac{2(hc+\lambda\phi)}{m\lambda}}$

B. $\frac{2(hc+\lambda\phi)}{m\lambda}$

C. $\sqrt{\frac{2(hc-\lambda\phi)}{m\lambda}}$

D. $\sqrt{\frac{2(h\lambda-\phi)}{m}}$

Answer:

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18. If the kinetic energy of a free electron doubles , its de - Broglie wavelength changes by the factor

A. 2

B. $\frac{1}{2}$

C. $\sqrt{2}$

D. $\frac{1}{\sqrt{2}}$

Answer:

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19. Radiations of two photon's energy, twice and ten times the work function of metal are incident on the metal surface successsively. The ratio of maximum velocities of photoelectrons emitted in two cases is

A. $1:2$

B. $1:3$

C. $1:4$

D. $1:1$

Answer:

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20. The cathode of a photoelectric cell is changed such that the work function changes from $(W_1 \rightarrow W_2(W_2 > W_1)$. If the current before and after change are I_1 and I_2, all

other conditions remaining unchanged , then

(assuming $hv > W_2$)

A. $I_1 = I_2$

B. $I_1 < I_2$

C. $I_1 > I_2$

D. $I_1 < I_2 < 2I_1$

Answer:

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21. Monochromatic radiation emitted when electron on hydrogen atom jumps from first excited to the ground state irradiates a photosensitive material. The stopping potential is measured to be $3.57V$. The threshold frequency of the material is

A. 4×10^{15} Hz

B. 5×10^{15} Hz

C. 1.6×10^{15} Hz

D. 2.5×10^{15} Hz

Answer:

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22. Photoelectric work- function of a metal is $1eV$. Light of wavelength $\lambda = 3000\text{Å}$ falls on it. The photoelectrons come out with maximum velocity

A. 10 metres/sec

B. 10^2 metres/sec

C. 10^4 metres/sec

D. 10^6 metres/sec

Answer:

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23. When the energy of the incident radiation is increased by 20% , kinetic energy of the photoelectrons emitted from a metal surface increased from $0.5eV \rightarrow 0.8eV$. The work function of the metal is

A. 0.65 eV

B. 1.0 eV

C. 1.3 eV

D. 1.5 eV

Answer:

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24. The maximum distance between interatomic lattice planes is 15 Å. The maximum wavelength of X-rays which are diffracted by this crystal will be

A. 15 Å

B. 20 Å

C. 30 Å

D. 45 Å

Answer:

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25. In photoelectric effect, stopping potential for a light of frequency n_1 is V_1. If light is

replaced by another having a frequency n_2 then its stopping potential will be

A. $V_1 - \frac{h}{e}(n_2 - n_1)$

B. $V_1 + \frac{h}{e}(n_2 + n_1)$

C. $V_1 + \frac{h}{e}(n_2 - 2n_1)$

D. $V_1 + \frac{h}{e}(n_2 - n_1)$

Answer:

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26. The maximum kinetic energy of the photoelectrons ejected from a photocathode when it is irradiated with light of wavelength 440nm is 1eV. If the threshold energy of the surface is 1.9eV, then which of the following statement is/are incorrect?

A. The threshold frequency for photo sensitive metal is $4.6 \times 10^{14} Hz$

B. The minimum wavelength of incident light required for photoemission is 6513

Å

C. The maximum wavelength of incident light required for photoemission is 6513 Å

D. The energy of incident photon is 2.9 eV

Answer:

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27. The work functions of metals A and B are in the ratio $1:2$. If light of frequencies f and $2f$ are incident on the surfaces of A and B respectively , the ratio of the maximum kinetic energy of photoelectrons emitted is (f is greater than threshold frequency of A, $2f$ is greater than threshold frequency of B)

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer:

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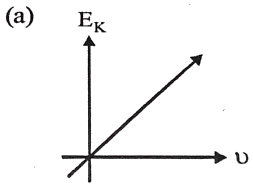
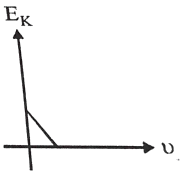
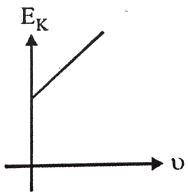
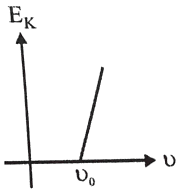
28. Which one of the following graphs represents the variation of maximum kinetic energy (E_K) of the emitted electrons with frequency u in photoelectric effect correctly ?

A. 

B. (b) 

C. (c) 

D. (d) 

Answer:

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29. The potential difference that must be applied to stop the fastest photoelectrons emitted by a nickel surface , having work function $5.01eV$, when ultraviolet light of $200nm$ falls on it , must be

A. 2.4 V

B. $-1.2V$

C. $-2.4V$

D. $1.2V$

Answer:

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30. X- rays are produced in an X- rays tube operating at a given accelerating voltage . The wavelength of the continuous X- rays has values from

A. 0 to ∞

B. $\lambda_{\min}$ to ∞, where $\lambda_{\min} > 0$

C. 0 to $\lambda_{\max}$, where $\lambda_{\max} < \infty$

D. $\lambda_{\min}$ to $\lambda_{\max}$, where

$$0 < \lambda_{\min} < \lambda_{\max} < \infty$$

Answer:

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31. Electrons used in an electron microscope are accelerated by a voltage of $25kV$. If the voltage is increased to $100kV$ then the de - Broglie wavelength associated with the electrons would

A. increase by 2 times

B. decrease by 2 times

C. decrease by 4 times

D. increase by 4 times

Answer:

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32. In the Davisson and Germer experiment , the velocity of electrons emitted from the electron gun can be increased by

A. increasing the potential difference between the anode and filament

B. increasing the filament current

C. decreasing the filament current

D. decreasing the potential difference between the anode and filament

Answer:

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33. Lights of two different frequencies whose photons have energies 1 and 2.5 eV, respectively, successively illuminate a metal whose work function is 0.5 eV. The ratio of the maximum speeds of the emitted electrons

A. $1:4$

B. $1:2$

C. $1:1$

D. $1:5$

Answer:

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34. 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 values of kinetic energy of the photoelectrons emitted in the two cases are in the ratio of $1 : k$, then the threshold frequency of the metallic surface is

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

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

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

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

Answer:

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35. Which of the following is/are false regarding cathode rays?

A. They produce heating effect

B. They don't deflect in electric field

C. They cast shadow

D. They produce fluorescence

Answer:

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36. The ratio of the respective de Broglie wavelengths associated with electrons accelerated from rest with the voltages 100 V, 200 V and 300 V is

A. $1:2:3$

B. $1:4:9$

C. $1:\frac{1}{\sqrt{2}}:\frac{1}{\sqrt{3}}$

D. $1:\frac{1}{2}:\frac{1}{3}$

Answer:

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37. A $5W$ source emits monochromatic light of wavelength 5000Å. When placed $0.5m$ away , it liberates photoelectrons from a

photosensitive metallic surface . When the source is moved to a distance of $1.0m$ the number of photoelectrons liberated will be reduced by a factor of

A. 8

B. 16

C. 2

D. 4

Answer:

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38. In the photoeletric effect, electrons are emitted

A. at a rate that is proportional to the amplitude of the incident radiation

B. with a maximum velocity proportional to the frequency of the incident radiation

C. at a rate that is independent of the emitter

D. only of the frequency of the incident radiations is above a certain threshold value

Answer:

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39. The threshold frequency of a certain metal is $3.3 \times 10^{14} Hz$. If light of frequency $8.2 \times 10^{14} Hz$ is incident on the metal, predict

the cut off voltage for photoelectric emission.

Given Planck's constant, $h = 6.62 \times 10^{-34} Js$.

A. 2 V

B. 3 V

C. 5 V

D. 1 V

Answer:

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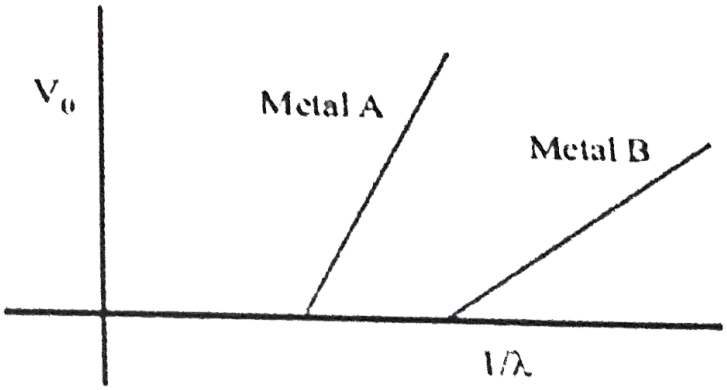
40. In an experiment on photoelectric effect, a student plots stopping potential V_0 against reciprocal of the wavelength λ of the incident light for two different metals A and B. These are shown in the figure



Looking at the graphs, you can most appropriately say that :

A. Work function of metal B is greater than that of metal A

B. For light of certain wavelength falling on both metal, maximum kinetic energy of electrons emitted from A will be greater than those emitted from B

C. Work function of metal A is greater than that of metal B

D. Students data is not correct

Answer:

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41. White X-rays are called 'white' due to the fact that:

A. they are electromagnetic radiations having nature same as that of white light

B. they are produced most abundantly in X ray tubes

C. they have a continuous wavelength range

D. they can be converted to visible light using coated screens and photographic plats are affected by them just like light

Answer:

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42. The wavelength associated with an electron accelerated through a potential difference of $100V$ is nearly

A. 1000 Å

B. 100 Å

C. 10.5 Å

D. 1.2 Å

Answer:

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43. Monochromatic light of frequency $6.0 \times 10^{14} Hz$ is produced by a laser. The power emitted is 2×10^{-3} w. The number of photons emitted, on the average, by the sources per second is

A. 5×10^{16}

B. 5×10^{17}

C. 5×10^{14}

D. 5×10^{15}

Answer:

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44. The de-Broglie wavelength of neutron in thermal equilibrium at temperature T is

A. $\frac{30.8}{\sqrt{T}}\text{Å}$

B. $\frac{3.08}{\sqrt{T}}\text{Å}$

C. $\frac{0.308}{\sqrt{T}}\text{Å}$

D. $\frac{0.0308}{\sqrt{T}}\text{Å}$

Answer:

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45. Which of the following cannot be explained on the basis of photoelectric theory ?

A. Instantaneously emission of photoelectrons

B. Existence of threshold frequency

C. Sufficiently intense beam of radiation can emit photoelectrons

D. Existence of stoping potential

Answer:

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