PHYSICS

BOOKS - MODERN PUBLICATION

Particle Nature of Radiation

Example

1. Find the photon energy in eV for electromagnetic wave of wavelength (λ) 1 m.

Given that

$h = 6.63 \times 10^{-34} Js, e = 1.6 \times 10^{-19} C.$

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2. Work function of Na is 2.75 eV. Does sodium show photelectric emission for light of wavelength $6,800 \overset{\circ}{A}$?

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3. The energy of photoelectrons emtted from a photo-snsitive plate is 1.56 eV if threshold waveelngth is $2,500 \circ A$,calculate the waveelngth of incident light.Given ,1ev $= 1.6 \times 10^{-12} erg$ and $h = 6.62 \times 10^{-27}$ erg s.

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4. If a light wave of wavelength $4,950 \overset{\circ}{A}$ is viewed as a continous flow of photos,what is the energy of each photon in eV?Given that

Planck's constatnt, $h = 6.6 \times 10^{-34} Js, c = 3 \times 10^{8} ms^{-1}$.

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5. Calculate the number of photons in 6.62 J of radiation energy of frequency 10^{12} Hz. Given $h = 6.62 \times 10^{-34}$ Js.

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6. If 5 % of the energy supplied to an incandescent light bulb is radiated as visible ligth,how many visible light photons are emitted y a 100 watt bulb?Assume the average wabelength of all visible photons to be $5,600D$.Given,$h = 6.625 \times 10^{-34} Js$.

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7. Calculate the energy of a photon, whose frequency is 1,000 kHz.

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8. Calculate the energy of a photon, whose wavelength is $5,890\overset{\circ}{A}$,

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9. Calculate the energy of a photon, whose wavelength is $1\overset{\circ}{A}$.

Also express the energy of the photos in eV in each case. Given ,

$1eV = 1.6 \times 10^{-19} J$, $h = 6.62 \times 10^{-34} Js$ and $c = 3 \times 10^{8} ms^{-1}$.

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10. An X - ray tube produces a continous spectrum of radiation with its short wavelength end at $0.66 \overset{\circ}{A}$.What is the maximum energy of a photon in the radiation?

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11. An X - ray tube produces a continous spectrum of radiation with its short wavelength end at $0.66\overset{\circ}{A}$.What is the maximum energy of a photon in the radiation? From you answer to (a) ,guess what order of accelerating voltage (for electrons) is required in wuch a tube.

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12. Light of wavelength $3,500\overset{\circ}{A}$ is incident on two metals A and B.Which metla will yield

photo - electrons,if their work functions are 4.2 eV and 1.9 eV respectively?

A. both 1 and 2 emit photoelectrons

B. Only 2 emit photoelectrons

C. Only 1 emit photoelectrons

D. neither 1 nor 2 emit photoelectrons

Answer:

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13. A emtal has threshold waveelngth of $6,000\overset{\circ}{A}$.Calculate

threshold frequecy

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14. A emtal has threshold waveelngth of $6,000\overset{\circ}{A}$.Calculate

the work function of metal in eV.

Given,$h = 6.62 \times 10^{-34} Js$ and

$e = 1.6 \times 10^{-19} C.$

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15. Calcualte the maximum kenteic erngy of electrons emitted from a photosensitive surface of work function 3.2 eV,for the incident raidation of waveelngth 300 nm.

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16. Define the term work function of a metal. The threshold frequency of a metal is f_0 when the light of frequency $2f_0$ is incident on the

metal plate, the maximum velocity of electrons emitted is v_1, when the frequency of the incident radiation is increased to $5f_0$, the maximum velocity of electrons emitted is v_2. Find the ratio of v_1 and v_2.

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17. A radiation of $5000\mathring{A}$ is incident on metal surface whose work- function is 1.2 eV. find out the value of stopping potential.

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18. By how much would the stopping potential for a given photosensitive surface go up, if the frequency f the incident radiations were to be in creased from $4 \times 10^{15} Hz$ to $8 \times 10^{15} Hz$?

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19. A metal has a work function of 2.0 eV. Is is illuminated by monochromatic light of wavelength 500 nm. Calculate the threshold wavelength.

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20. A metal has a work function of 2.0 eV. Is is illuminated by monochromatic light of wavelength 500 nm. Calculate the maximum energy of photoelectrons,

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21. A metal has a work function of 2.0 eV.Is is illuminated by monochromatic ligth of

wavelenth 500 nm.Calculate :

The stopping potential .Given,Planck's constant $h = 6.6 \times 10^{-34} Js$,charge on elecron $e = 1.6 \times 10^{-19} C$ and $1eV = 1.6 \times 10^{-19} J$.

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22. Find the number of photons emitted per second by a 25 W source of monchromatic light of wavelength $6,000 \overset{\circ}{A}$.

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23. Radiation of wavelength 180 nm ejects photoelectrons from a plate whose work funcion is 2.0 eV. If uniform magnetic field of flux density $5.0 \times 10^{-5} T$ is applied parallel to the plate, what should be the radius of the path followed by electrons ejected normally from the plate with maximum energy.

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24. Aj photon of waveelngth $3,310\overset{\circ}{A}$ falls ion a photocathode and an electron of energy $3 \times 10^{-19} J$ is ejected.If the waveelngth of the incident photos is changed to $5,000\overset{\circ}{A}$,the energy of the ejected electron is $0.972 \times 10^{-19} J$.Claulate the value of Planck's constant and threshold waveelngth of the photocathode.Given the velocity of light $= 3 \times 10^{8} ms^{-1}$.

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25. When a beam of 10.6 eV photos of intensity $2Wm^{-2}$ falls on a platinum surface of area $10^{-4}m^2$ and work function $5.6eV, 0.53\,\%$ of the incient photos eject photoelectrons.Find the number of photoelectrons emitted per second and their minimum and maximum energies (in eV).Take$1eV = 1.6 \times 10^{-19}J.$

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26. A beam of light has three wavelengths $4144\overset{\circ}{A}, 4972\overset{\circ}{A}$ and $6216\overset{\circ}{A}$with a total

instensity of $3.6 \times 10^{-3} Wm^{-2}$ equally distributed amongst the three wavelengths. The beam falls normally on an area 1.0 cm^2 of a clean metallic surface of work function 2.3 eV. Assume that there is no loss of light by reflection and that each energetically capable photon ejects on electron. Calculate the number of photo electrons liberated in two seconds.

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27. Two metallic plate A and B , each of area $5 \times 10^{-4} m^2$, are placed parallel to each at a separation of 1 cm plate B carries a positive charge of $33.7 \times 10^{-12} CA$ monocharonatic beam of light , with photoes of energy 5 eV each , starts falling on plate A at t = 0 so that 10^{16} photons fall on it per square meter per second. Assume that one photoelectron is emitted for every 10^6 incident photons fall on it per square meter per second. Also assume that all the emitted photoelectrons are collected by plate B and the work function of

plate A remain constant at the value 2 eV Determine

(a) the number of photoelectrons emitted up to i = 10s

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28. Two metallic plate A and B , each of area $5 \times 10^{-4} m^2$, are placed parallel to each at a separation of 1 cm plate B carries a positive charge of $33.7 \times 10^{-12} CA$ monocharonatic beam of light , with photoes of energy 5 eV

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(b) the magnitude of the electron field between the plate A and B at i = 10 s

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29. The peak emission from a black body at a certain temprature occurs at a wavelength of $9000\overset{\circ}{A}$. On increase its temperature , the total radiation emmited is increased its 81 times. At the intial temperature when the peak radiation from the black body is incident on a metal surface , it does not cause any photoemission from the surface . After the increase of temperature, the peak from the black body caused photoemission. To bring these photoelectrons to rest , a potential equivalent to the excitation energy between n

= 2 and n = 3 bohr levels of hydrogen atoms is required. Find the work function of the metal.

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30. Which phenomenon illustrats the particle nature of light?

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31. What is photoelectric effect?

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32. What are photoelectrons?

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33. Mention one physical process for the release of electrons from the surface of a metal.

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34. Do X - rays show the phenomenon of phototelectric effect?

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35. Define intensity of radiation on the basis of photon picture of ligth.Write its SI unit.

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36. Define thresold wavelength for phtoelectric effect.

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37. What is threshold frequency in relation to photoelectric effect?

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38. Define thresold frequency for photoelectric emiision.

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39. What conclusion do you draw,when a radiation of frequency $10^{16} Hz$ fails to produce photoeletrons from a metal surface?

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40. Does the thresold frequency depend on intensity of light?

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41. Red light, however bright, it cannot produce the emission of electrons from a clean zinc surface, but even weak from a clean zinc surfaces, but even weak ultraviolet radiation can do so, why?

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42. What determines the strength of photoelectric current?

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43. If the intensity of incident radiataions on a metal is doubled, what happens to the K.E. of electrons emitted.

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44. What is the effect of decrease in wavelength of incident light on the velocity of photoelectrons?

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45. What is the effect on the velocity of the photo-electrons,if the wavelength of the incident light is decreased?

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46. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the

frequency?

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47. What is stopping potenetial in photoelectric effect?

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48. If intenstiy of radiation incident on a photosensetative plate is doubled,how does the stoping potential change?

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49. How does retarding potential vary with intenstiy of light causeing photelectric erffect?

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50. If the intensity of incident radiations in a photocell is increased, how does the stopping potential vary?

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51. How will the stopping potential vary?

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52. How will the stopping potential chnge,if the frequency of the radiation incident on a metal surface is increased?

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53. How does retarding potential vary with intenstiy of light causeing photelectric erffect?

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54. If the frequency of the incident radiation is equal to the threshold feqeucy,what will be the value of the stopping potensttial in photoelectric effect?

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55. If the maximum kinetic energy of electrons emitted by a photo cell is 5 eV,what is the stopiing potential?

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56. The freqeuncy(v) of incident radiation is greqter than threshold freqeucy (v_0) in a photocell.How will the stopping potential vary ,if frequency(v) is increased,keeping other factors constant?

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57. On which factor does the energy carried by a quantum of light depend?

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58. What is the rest mass of a photon?

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59. Calculate the frequency associated with a photohn of energy $3.3 \times 10^{-20} J$.Give n, $h = 6.6 \times 10^{-34} Js$.

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60. What is the enrergy associated in joule with a photon of wavelength $4,000\overset{\circ}{A}$?

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61. Find the momentum of a photon of wavelength $0.01\overset{\circ}{A}$.

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62. Calculate the momentum of a photon having freqeuncy $5 \times 10^{13} Hz$.Given that $h = 6.6 \times 10^{-34} Js$ and $c = 3 \times 10^{8} ms^{-1}$.

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63. Name a physical quantity ,whose dimensions are same as those of Planck's constant.

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64. Which photon is more energetic :A red one or a violet one?

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65. Define electron volt. What is its value?

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66. How many joules make one electron volt?

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67. What is the frequency of a photon,whose energy is $66.3eV$?Given ,$h = 6.673 \times 10^{-34} Js$.

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68. Define work function of metal and photoelectric effect.

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69. Define the photelectric work function of a metal.

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70. Why are alkali metals most suited as photosensitive materials?

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71. Do non-metals show photoelectric effect?

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72. The threshold freqeucny of a material is $2 \times 10^{14} Hz$.What is its work function?

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73. For a photosensitive surface,work function is $3.3 \times 10^{-19} J$.Taking Planck's constant to be $6.6 \times 10^{-34} Js$,ifnd threshold frequency.

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74. Calculate the threshold frequency of photon for photoelelectric emission from a metal of work function 0.1 eV.

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75. Calculate the work function of a metal in eV,if its threshold waveelngth is $6,800^{A}$ and $h = 6.62 \times 10^{-27} ergs.$

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76. Is photoelectric emission possible at all frequencies?

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77. Why no electron is emitted from a wooden table when light from a bulb falls on it?

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78. Two metal A and B have work functions, 2eV and 5eV respectively. Which metal has lower threshold wavelength?

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79. The work function of metal A is higher than the work function of metal B. which of these metals has higher threshold wavelength?

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80. How deos the maximum kinetic energy of electrons emitted vary with the work function of the metal?

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81. Write Einstein's photoelectrical equation in terms of the stopping potential and the threshold frequency for a given photosensitive material. Draw a plot showing the variation of stopping potential vs the frequency of incident radiation.

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82. If the frequency of the incident radiation is equal to the threshold feqeucy,what will be the value of the stopping potensttial in photoelectric effect?

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83. If the intensity of incident radiations in a photocell is increased, how does the stopping

potential vary?

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84. The maximum kinetic energy of phtoelectrons emitted from a surface,when photons of energy 6 eV fall on it,is 4 eV.The stpping potential (in volt) is

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85. Can the phenomenon of photoelectric effect be explained on the basis of wave theory ?

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86. Why the photoelectric cell is also called an elecric eye?

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87. Explain two method of elecron emission.

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88. If radiation has both the particle and wave properties,how can one decide which property to use in describing phenomenon of polarization?

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89. Monochromatic light of frequency $6 \times 10^{14} Hz$ is produced by a LASER .the power emitted is $2 \times 10^{-3} W$.The number of phtotons smitted,on the average ,by the source per second is

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90. Define photoelectric effect and threshold frequency.

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91. The following table given the value fo work function for a few photosensitive metals: If each of these metals is exposed to radiation of wavelength 300 nm , which of them will not emit photoelectrons and why ?

S.No.	Metal	Work function (eV)
1.	Na	1.92
2.	K	2.15
3.	MO	4.17

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92. Define photoeletjric effect ,work function,stopping potential and threshold frequency.a

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93. State the four laws of photoelectric emission.

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94. State the four laws of photoelectric emission.

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95. Photoelectric emission is an instantaneous process.Comment.

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96. In the photoelectric effect, there is a cut - off frequency. How does the photon picture explain this fact?

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97. Explain briefly, how classical theory could not explain the phenomenon of photoelectric effect.

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98. Explain the effect of increase of intensity of incident radiation on photoelectric current with suitable graphs.

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99. Explain the effect of increase of intensity of incident radiation on photoelectric current with suitable graphs.

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100. Draw a plot showing the variation of photoelectric current versus the intensity of incident radiation on a given photosensitive surface.

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101. Electrons are emitted from a photosensitive surface, when it is illuminated by green light but electron emission does not take lace by yellow light. Will the electrons be

emitted when the surface is illuminated by red light

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102. Electrons are emitted from a photosensitive surface, when it is illuminated by green light but electron emission does not take lace by yellow light. Will the electrons be emitted when the surface is illuminated by blue light?

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103. Green light ejects electrons from a certain photosensitive surface, yellow light does not. Will red and violet light eject electrons from the same surface?

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104. Blue light can eject electrons from a Photo-sensitive surface, while orange cannot. Will violet and red light eject electrons from the same surface?

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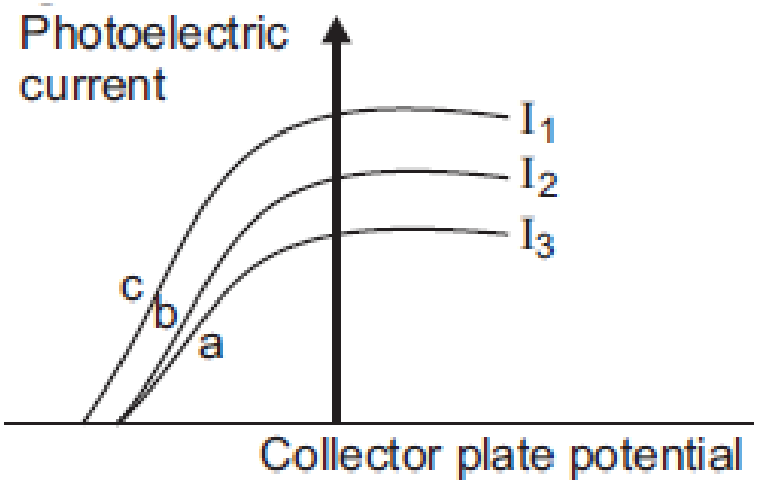
105. The figure VSAQ 29 shows a plot of three curves a,b,c, showing the variation of photocurrent in collector plate potential for three different intensities I_1, I_2 and I_3 having frequencies v_1, v_2 and v_3 respectively incident on a photosensitive surface. Point out the two curves for which the incident raidations have

the same frequency but different intensities.



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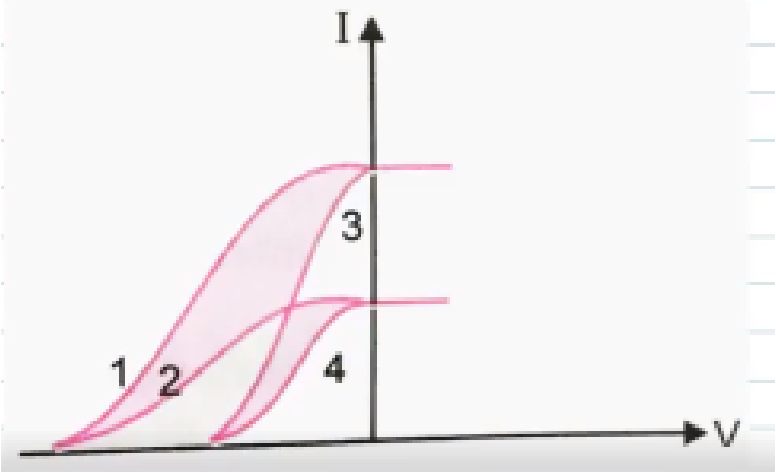
106. The graph of Fig. shows the variation of photoelectric current (I) versus applied voltage (V) for the two different photosensitive materials for two different intensities of the

incident radiation. Identify the pairs of curves that correspond to different materials but same intensity of incident radiation.



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107. Draw suitable graphs to show the variation of photoelectric current with

collector plate potenetial for

a fixed frequency but different intensities $L_1 > L_2 > L_3$ of radiation?

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108. Draw suitable graphs to show the variation of photoelectric current with collector plate potenetial for

a fixed fintensity but different frequencies $v_1 > v_2 > v_3$ of radiation.

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109. If we go on increasing the wavelength of light on a metal surface, what changes in the number of electrons

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110. If we go on increasing the wavelength of light on a metal surface, what changes the kinetic energy take place?

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111. Two monochromatic radiations blue and violet of the same intensity are incident on a photosensitive surface cause photoelectric emission. Would the no. of electrons emitted per sec be equal in the two cases? justify

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112. Two monochromatic radiations blue and violet of the same intensity are incident on a photosensitive surface cause photoelectric emission. Would the maximum kinetic energy

of the electrons be equal in the two cases? justify

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113. The number of ejected photoelectrons increases with the increases in intensity of light but not with the increase in frequecy.Why?

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114. An increase in the intensity of incident light does not change the veloctiy of the eitted photoelectrons.Why?

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115. A source of light is placed at a distance of 1m. From a photocell and the cut off potential is found to be $V0$. If the distance is doubled what will be the cut off potential?

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116. A source of light is placed at a distance of 1m. From a photocell and the cut off potential is found to be $V0$. If the distance is doubled what will be the cut off potential?

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117. Plot a graph showing the variation of stopping potential (v_0) with the frequency (v) of the incident radiation for a given photosensitive material.Hence state the

singificanace of trhe threshold freqeuncy in photoelecric emissin.

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118. Sketch a graph between frequency of incident radiations and stopping potential for a given photosensitive material. What information can be obtained from the value of the intercept of potential axis?

A source of light of frequency of greater than the threshold freuency is placed at a distance

of 1 m from the cathode of a photocell? the distnace of hte light sources from the cathode is reduced explain giving reasons, what change will you observe in the

Stopping potential.

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119. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing

the

frequency?

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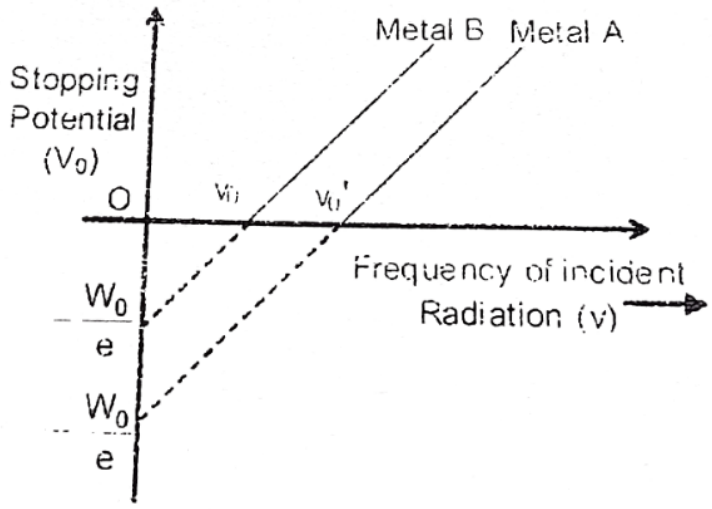
120. The graph shows variation of stopping potential V_0 versus frequency of incident radiation v for two photosensitive metals A and B. Which of two metals has higher

threshold frequency and why?



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121. What are Photons? Give its two properties.

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122. Define work function of metal and photoelectric effect.

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123. Defien photoelectric work function and threshold frequency.

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124. The work function of metal A is higher than the work function of metal B. which of

these metals has higher threshold wavelength?

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125. It is harder to remove a free eletron from copper than from sodium .Which metal has greater work function?Which has higher threshold waelength?

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126. Visible light cannot eject photo electrons from copper metal, whose work function is 4.4 e V. Why? Prove it mathematically.

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127. Two metals X and Y have work functions 2eV and 5eV respectively. Which metal will emit electrons when it is irradiated with light of wavelenth 400 nm and why?

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128. Every mrtal has a definite work function. Why do all photoelectrons not come out with same energy, if incident radiation is monochromatic? Why is there an energy distribution of photoelectrons?

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129. Is it essential that each incident photos should eject a photoelecton?Explain.

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130. Define the following terms for a given photosensitive surface:

Threshold wavelength

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131. Define the following terms for a given photosensitive surface:

Work function.

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132. Define photoeletjric effect ,work function,stopping potential and threshold frequency.a

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133. Define the photelectric work function of a metal.

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134. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the

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135. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the

photoelectric current affected on increasing the

frequency?

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136. Calculate the work function of a metal in eV,if its threshold waveelngth is $6,800^{A}$ and $h = 6.62 \times 10^{-27} ergs.$

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137. Sate Einstein's photoelectrci equation and explain the terms involved.

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138. Write Einstein's photoelectric equation.State clearly the three salient feaures obbsrved in photoelectric effect,which can be explained on the basis of the above equation.

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139. Why does the maximum velocity of photo-electron not depend upon the inetensity of radiation ?Explain.

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140. If the frequency of the incident radiation on the cathode of a photocell is doubled ,how will the following change:

kinetic energy of the elecrons,

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141. If the frequency of the incident radiation on the cathode of a photocell is doubled ,how will the following change:

photoelectric current,

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142. If the frequency of the incident radiation on the cathode of a photocell is doubled ,how will the following change:

stopping potential.

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143. For a photosensitive surface,threshold wave-length is λ_0.Does photoemission occur,if the wavelength (λ) off the incident radiation is

more than λ_0,

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144. For a photosensitive surface,threshold wave-length is λ_0.Does photoemission occur,if

the wavelength (λ) off the incident radiation is

less than λ_0?Justify you answer.

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145. An increase in frequency of incident light increases the velocity with which a photoelectron is ejhected .Explain.

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146. Radiation of frequency $10^{15} Hz$ is incident on two photosensitive surfaces P and Q.Following observations are made:

Surface P,Photoenmission occurs but the photo-electrons have zero kinetic energy.

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147. Radiation of frequency $10^{15} Hz$ is incident on two photosensitive surfaces P and Q.Following observations are made:

Surface Q:Photoemissin occurs and photo-electrons have some kinetic energy.

148. For photoelectric efect in a metal ,Fig1.18 shows the plot of cut off voltage versus fequency of incidet radiation.Calculate

the threshold frequency

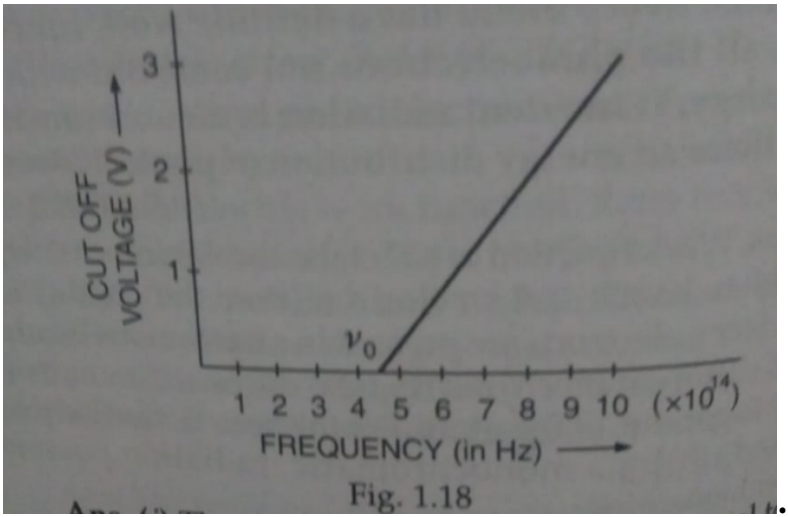

Fig. 1.18

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149. For photoelectric efect in a metal ,Fig1.18 shows the plot of cut off voltage versus fequency of incidet radiation.Calculate

the work function for the given metal.

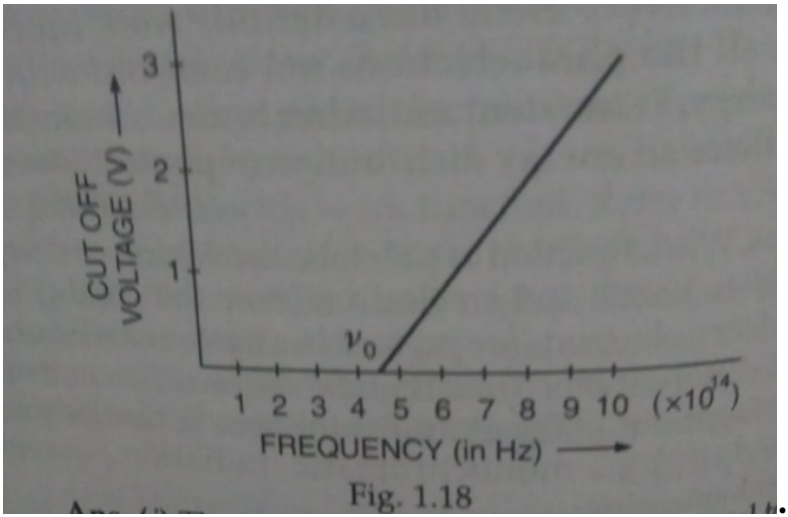

Fig. 1.18

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150. Draw a graph to show the variation of stopping potential with frequency of radiations incident on a meetal plate .How can

the value of Planck's constant be determined rom this graph?

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151. Draw a graph to show the variation of stopping potential with frequency of radiations incident on a meetal plate .How can the value of Planck's constant be determined rom this graph?

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152. Draw a graph to show the variation of stopping potential with frequency of radiations incident on a meetal plate .How can the value of Planck's constant be determined rom this graph?

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153. Plot a graph showing the variation of stopping potential (v_0) with the frequency (v) of the incident radiation for a given photosensitive material.Hence state the

singificanace of trhe threshold freqeuncy in photoelecric emissin.

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154. Define the erms 'work funcion' and 'threshld frequency ' for phtoelectrci effect.Show graphically how stopping potential for a given metla varies with fequency of inciden radiation.What does the slope of this graph represent ?

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155. Explain the working of a photo cell.

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156. What is photo cell ? State its three applications.

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157. Write any two uses of photocell.

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158. Explain why,for the photoelectric effect,the existens of a threshold frequency and a very short emission time provide evidence for the particulate nature of elecro-magnetic radiation,as opposed to a wave theory.

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159. State and explain two relations in which the Planck constnat h is the constant of

proportionality.

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160. When monochromatic radiation of wavelength $2,000\overset{\circ}{A}$ falls upon a nickel plate,the latter acquires a positive charge.Thye wavelength is increased at $3,400\overset{\circ}{A}$ however intense the incident radiation may be,the effect is found to cese.Explain it.

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161. Explain

What is meant by a photon

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162. Explain

why most electrons are emitted with kinetic energy less than the maximum.

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163. The photoelectric effect provides evidence for the particulate nature of electromagnetic radiation.tate three experimental observations that support this concludion.

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164. Electromagnetic radiation of wavelength λ and intnesity I,when incident on a metal surface causes n,electrons to be ejected per unit time.The maximum kinetic energy of the electrons is $E_{\max}$.State and explain the

effect,iff any,on n and $E_{\max}$.When the intensity is reduced to $I/2$ but the waveelngth λ is uhnchanged and

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165. Electromagnetic radiation of wavelength λ and intnesity I,when incident on a metal surface causes n,electrons to be ejected per unit time.The maximum kinetic energy of the electrons is $E_{\max}$.State and explain the effect,iff any,on n and $E_{\max}$.When

the wavelength λ is reduced but the intesntity I is not changed.

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166. State the value of the ration $\frac{\text{energy of photon of light of waveelngth} 700nm}{\text{energy of photon of lgth of wavelngth} 350nm}$.

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167. Two bems of monochromatic ligth have similar intensities.The light in one beam has

wavelength 350 nm and the light in the other bem has waveelngth 700 nm.The two bems are incident separately on three different metal surfaces .'The work function of each of these suraces is as given in the following table:

Metal	Work function (eV)
Tungsten	4·49
Magnesium	3·68
Potassium	2·26

.

State which combination ,if any ,of monochromatic ligth and metal surface could give rise to photolelectric emission.Gie a quantitative explanation of your answer.

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168. Experiments are conducted to investigate the photoelectric effec.

It is found that on expousure of a metal srface to ligth,either electrons are emitted immediately or hey ar not emitted at all.Suggest why this observation odes not support a wave theory of light.

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169. When light of frequency $2.2x10^{10}$ ^ $(15)Hz$ is incident on a metal surface,the emitted photoelectrons are stopped by a negative anode potential of 6.6 V.When teh experiment is repeated with ligth of freuqency $4.6 \times 10^{15} Hz$,the stopping potential is found to be 16.5 V.Determine the Planck's constant.

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170. When the surface of a certain metal is illuminated with the light of wavelength λ,the emitted photoelectrons possess a maximum kinetic energy $K_{\max}$.Show that when light of waveelngth $\frac{hc\lambda}{hc + K_{\max}\lambda}$ is incident on the metal ,the emitted electrons will have maximum kinetic energy of $2K_{\max}$.

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171. Illuminating the surface of certain metal alternately with the light of wavelength λ_1 and $\lambda_2 \quad (\lambda_2 > \lambda_1)$,it was found that the corresponding maximum velocities of photoelectrons differ by a factor of n.Show that the work function of the metal is given by $\omega = hc\frac{\left(n^2 - \lambda_2/\lambda_1\right)}{\lambda_2(n^2-1)}$.

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Exercise

1. What is photoelectric effect? State it laws?

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2. What is photoelectric effect? State it laws?

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3. State the four laws of photoelectric emission.

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4. Explain the effect of increase of intensity of incident radiation on photoelectric current with suitable graphs.

5. With refrernece to the photoelectric effect,define the terms 'work function' and 'threshold wavelength' for a given metal.On what factors will the following depend during

phtotelelctric emission from a metal surface:

the magnitude of phtotelectric curent, and

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6. With refrernece to the photoelectric effect,define the terms 'work function' and 'threshold wavelength' for a given metal.On what factors will the following depend during phtotelelctric emission from a metal surface:

the velocity of ejected electrons?

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7. What is phtotelecric effect?Explain the effect of increase of frequency of incident radiation on photoelectric current.

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8. What is phtotelecric effect?Explain the effect of increase of intensity of incident radiation on photoelectric current.

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9. Explain 'stopping potential' and 'threshold frequency' in photoelectric emission.Give an appropriate graph.

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10. Plot a graph showing the variation of photoelectric current with anode potential for

two ligth beams of same wav elength but different intensity.

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11. Does the stopping potential in photoelectric emissiondepend upon the intensity of the incident radiation in a photocell?

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12. Does the stopping potential in photoelectric emissiondepend upon the frequency of the incident radiation?

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13. In a plot of photoelectric current versus anode potential how does The saturation current vary with anode potenetial for incident radition of different frequencies but same intensity?

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14. In a plot of photoelectric current versus anode potential how does

the stopping potential vary for incident radiations of differnet intensitites but same frequency ?

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15. In a plot of photoelectric current versus anode potential how does

photoelectric current vary for different intensitites but same frequency of incident radiation ?

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16. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the

frequency?

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17. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the

intensity of incident radiation and why?

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18. State the dependence of work function on kinetic energy of electrons emitted in a photocell. If the intensity of the incident radiation is doubled, what changes occur in the stopping potential and photoelectric current?

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19. Explain 'stopping potential' and 'threshold frequency' in photoelectric emission.Give an appropriate graph.

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20. Explain briefly, how classical theory could not explain the phenomenon of photoelectric effect.

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21. Derive Einstein's' photoelectric equation in terms of frequency.

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22. What is Einstein's photoelectric equation? Explain how it satisfies the various laws of photoelectric effect?

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23. What is photoelectric effect? State it laws?

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24. Write Einsteins's photoelectric equation.

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25. State the four laws of photoelectric emission.

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26. What is Einstein's photoelectric equation? Explain how it satisfies the various laws of

photoelectric effect?

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27. What is Einstein's photoelectric equation? Explain how it satisfies the various laws of photoelectric effect?

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28. Write Einstein's photoelectric equation.State clearly the three salient feaures

obbsrved in photoelectric effect,which can be explained on the basis of the above equation.

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29. What is photoelectric effect?

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30. Write Einsteins's photoelectric equation.

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31. What is photoelectric effect?

Watch Video Solution

32. What is Einstein's photoelectric equation? Explain how it satisfies the various laws of photoelectric effect?

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33. Define the terms

cut-off voltage and

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34. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing the

frequency?

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35. What is photo cell ? State its three applications.

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36. What is photoelectric cell? Explain any one of the photoelectric cells.

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37. What is photoelectric cell?How dies it work ?Give its practical uses.

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38. Discuss suitable experiment to study the laws of photoelectric emission.

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39. Discuss suitable experiment to study the laws of photoelectric emission.

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40. What is phtotelecric effect?Explain the effect of increase of frequency of incident radiation on photoelectric current.

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41. What is phtotelecric effect?Explain the effect of increase of intensity of incident radiation on photoelectric current.

Watch Video Solution

42. What is photoelectric effect? State it laws?

Watch Video Solution

43. Write Einsteins's photoelectric equation.

Watch Video Solution

44. State the four laws of photoelectric emission.

Watch Video Solution

45. Define the term threshold frequency and stopping potential in relation to phenomenon of photoelectric effect. How is the photoelectric current affected on increasing

the

frequency?

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46. Draw properly labelled graphs to show the following concerning photoelectric emission: variation of photoelectrons current with the intensity of incident radiatio,

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47. Draw properly labelled graphs to show the following concerning photoelectric emission: variation of photoelectron current with accerlarating and retarding potenetial ,and

Watch Video Solution

48. Draw properly labelled graphs to show the following concerning photoelectric emission: variation of stopping potential with fequency of the incident radiation.From the graph

,explain how the following can be determined:

Planck's constant

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49. Draw properly labelled graphs to show the following concerning photoelectric emission: variation of stopping potential with fequency of the incident radiation.From the graph ,explain how the following can be determined: the threshold frequency for the photosensitive material, and

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50. Draw properly labelled graphs to show the following concerning photoelectric emission: variation of stopping potential with fequency of the incident radiation.From the graph ,explain how the following can be determined: the work function of the material.

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51. Write down Einstein's photoelectric equation and explain it .With the help of a neat diagram,describe briefly the constructin and working of a photoemissive cell.Mention any four applications of phtotlectric effect.

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52. Calculate the frequency associated with a photohn of energy $3.3 \times 10^{-20} J$.Give n, $h = 6.6 \times 10^{-34} Js$.

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53. Calculate the energy of a photon of green light of waveelngth $5,500\overset{\circ}{A}$.Given , $h = 6.62 \times 10^{-27} ergs..$

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54. The wavelength of a spectral line is $4,000\overset{\circ}{A}$ .Calculate its frequency and energy .

Given , $c = 3 \times 10^{8} ms^{-1}$ and $h = 6.6 \times 10^{-34} Js.$

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55. Calculate the frequency of a photon,whose energy is 7.5 eV.Given,$1eV = 1.6 \times 10^{-19} J$ and $h = 6.62 \times 10^{-34} Js$.

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56. Find the number of photons emitted per second by a 25 W source of monochromatic light of wavelength $6000 \overset{\circ}{A}$.

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57. Find

energy of each photon in eV having wavelength 632.8 nm

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58. Find

the number of photons wmitted er minute by 60 W lamp of moochromatic light of wavelength $5,000\overset{\circ}{A}$.

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59. Calculate the longest wavelength of the incident radiation, which will eject photoelectrons from a metal surface, whose work function is 3 eV.

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60. Calculate the threshold wavelength of photons, which can emit photoelectrons from

cesium. Given that work function for cesium = $1.8eV, h = 6.62 \times 10^{-34} Js.$

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61. Work function of a photosensitive metla is 1,875 e V.Calculate the waveelength of incident light ,which will just cause the emission of photoelectrons.

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62. The work function for a certain metal is 4.2 eV.Will this metal give photoelectric emission for incident radiation of waveleength 330 nm? Given that charge on elecron, $e = 1.6 \times 10^{-19} C$,velocity of light , $c = 3 \times 10^{8} ms^{-1}$ and Planck's constnat , $h = 6.62 \times 10^{-34} Js.$

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63. The work function of sodium is 2.3 eV .Calculate the maxi cuase phtotlectrons to be

emitted from sodium.

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64. A emtal has threshold waveelngth of $6,000\overset{\circ}{A}$.Calculate

threshold frequecy

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65. A emtal has threshold waveelngth of $6,000\overset{\circ}{A}$.Calculate

the work function of metal in eV.

Given,$h = 6.62 \times 10^{-34} Js$ and

$e = 1.6 \times 10^{-19} C.$

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66. Calculate the work function of a metal in eV,if its threshold waveelngth is $6,800^{A}$ and

$h = 6.62 \times 10^{-27} ergs.$

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67. A metal sheet is given a negative charge of 11.2 n C.

How many hotons of ultraviolet light is required to completley dicharge the metal sheet ?

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68. What is the minimum amount of energy that must be absorbed by metal to effect this discharge? Threshold frequency of metal $= 4.5 \times 10^{14} Hz, h = 6.6 \times 10^{-34} Js.$

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69. Light of waveelength $5,000\overset{\circ}{A}$ falls on a metal surface of work function 2.01 eV.Find the kinetic energy of phtotlectrons.

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70. Light of wavleength $5,000\overset{\circ}{A}$ falls on a photo sensitive plate with photoelectric work

function f 1.9 eV.The kinetic energy of phtotoelectrons emitted will be

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71. What is the enrergy of emitted photoelectrons,if light of frequency 10^{16} Hz is incident on a sodium target?Work functin of sodium = 2.5 eV.

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72. The threshold wavelength of photosensitive metal is $5,000\overset{\circ}{A}$ .Find the kinetic energy of the photoelectrons emitted by it, when radiation of wavelength $4,000\overset{\circ}{A}$ is incident on it. Express it in eV. Given $h = 6.625 \times 10^{-34} Js, c = 3 \times 10^{8} ms^{-1}$ and $e = 1.6 \times 10^{-19} C.$

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73. A sheet of silver is illuminated by monochromatic ultraviolet radiation of

wavelength=$1,810\overset{\circ}{A}$.What is the maximum energy of the emitted electron? Threshold wavelength of silver is $2,460\overset{\circ}{A}$.

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74. The energy of photoelectrons emtted from a photo-snsitive plate is 1.56 eV if threshold waveelngth is $2,500 \circ A$,calculate the waveelngth of incident light.Given ,1ev $= 1.6 \times 10^{-12} erg$ and $h = 6.62 \times 10^{-27}$ erg s.

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75. Light of wavelength $5,500\overset{\circ}{A}$ falls on a sensitive plate with work function 1.7 eV .Find energy of photon ,

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76. Light of wavelength $5,500\overset{\circ}{A}$ falls on a sensitive plate with work function 1.7 eV .Find energy of photoelectron and

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77. Light of wavelength $5,500\overset{\circ}{A}$ falls on a sensitive plate with work function 1.7 eV .Find stopping potential.

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78. Light of wavelength $5,000\overset{\circ}{A}$ falls on a sensitive plate with photelectric work function equal to 1.90 eV. Find the energy of the photon in eV,

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79. Light of wavelength $5,000\overset{\circ}{A}$ falls on a sensitive plate with photelectric work function equal to 1.90 eV. Find the energy of the photon in eV,

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80. Light of wavelength $5,000\overset{\circ}{A}$ falls on a sensitive plate with photelectric work function equal to 1.90 eV. Find the stopping potential.

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81. Ligth of waveelength $2,200\overset{\circ}{A}$ falls on a metal with work function 4.1 eV.Find teh maximum kinetic energy of th emitted elecrtrons and the stopping potential.Gien that

$h = 6.62 \times 10^{-34} Js, c = 3 \times x10^{8} ms^{9} - 1)$

and $e = 1.6 \times 10^{-19} C.$

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82. Find the frequency of light which ejects electrons from a metal surface, fully stopped by a retarding potential of 3 V. The photoelectric effect brings in this metal at a frequency of $6 \times 10^{14} Hz$. Find the work function for this metal $(Givenh = 6.63 \times 10^{-34} Js)/$

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83. The threshold frequency for 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 the photoelectric emission.

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84. If high waves of frequency 8.8×10^{14} Hz is incident on a metal surface of thresold frequency 4×10^{14} Hz, then determine the value of stopping potential (cut-off Potential) (Given $h = 6.6 \times 10^{-34}$ Js and e = $1.6 \times 10^{-19} C$)

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85. the work function of potassium is 2.3 eV.If the photoelectrons are emitted with maximum velocity of $10^6 ms^{-1}$,calculate the frequency of the incident radiation on the metal Given ,mass of electron,$m = 9.1 \times 10^{-31} kg$ and Planck's constnat ,$h = 6.62 \times 10^{-34} Js$.

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86. Work function of sodium is 2.35 eV.What is the maximum waveelngth of light that will cause phtotelectrons to be emitted from the metal ?What will be the maxium energy of the phtotlectrons,if radiatin of $1,000\overset{\circ}{A}$ falls on the metal surface $\left(h = 6.625 \times 10^{-34} Js\right)$.

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87. Find the frequency of light which ejects electrons from a metal surface, fully stopped by a retarding potential of 3 V. The

photoelectric effect brings in this metal at a frequency of $6 \times 10^{14} Hz$. Find the work function for this metal $(Givenh = 6.63 \times 10^{-34} Js)/$

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88. If phtotlectrons are to be emitted from a potassium surace with a speed of $6 \times 10^{6} ms^{-1}$,what frequency of radiation must be used?Give that threshold frequency for potassium is

$4.22 \times 10^{14} Hz, h = 6.6 \times 10^{-34} Js$ and

$m_e = 9.1 \times 10^{-31} kg.$

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89. Light of wavelength $2,000 \overset{\circ}{A}$ falls on an aluminium surface.In aluminium 4.2 eV are required to remove an electron.What is the kinetic energy in eV of

the fastest emiited electron

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90. Light of wavelength $2,000\overset{\circ}{A}$ falls on an aluminium surface.In aluminium 4.2 eV are required to remove an electron.What is the kinetic energy in eV of

the slowest emitted phtotelectrons?

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91. Light of wavelength $2,000\overset{\circ}{A}$ falls on an aluminium surface.In aluminium 4.2 eV are required to remove an electron.What is the

kinetic energy in eV of

the fastest emiited electron

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92. Light of wavelength $2,000\overset{\circ}{A}$ falls on an aluminium surface.In aluminium 4.2 eV are required to remove an electron.

find cut off waveelrnght for aluinium? Given,Planck's constant , $h = 6.6 \times 10^{-34} Js, c = 3 \times 10^{8} ms^{-1}$.

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93. When light of wavelength 400 nm is incident on the cathode of photocell,the stopping potential recorded is 6 V.If the wavelength of the incident light is increased to 600 nm , calcuulate the new stopping potential.

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94. When a surface is irradiated with a light of wavelength $4,950\overset{\circ}{A}$,a photocurrent appears

which vanishes,if a retarding potential greater than 0.6 V is applied croos the photo tube.When a different source of ligth is used,it is found that the critical retarding potential is changed to 1.1 V.Find the work function of the emitting surface and the wavelength of the second source.

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