PHYSICS

BOOKS - MARVEL PHYSICS (HINGLISH)

ELECTRONS AND PHOTONS

Multiple Choice Questions

1. The photocurrent is I_P when a certain number of photons is incident on a

photosensitive plate. If the number of photons is doubled, the photocurrent will be

A. $\sqrt{3}I_P$

B. $\sqrt{2}I_P$

C. $2I_P$

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

Answer: C

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2. The phenomenon which is just opposite (reverse) to the photoelectric effect is

A. pair production

B. production of X-rays

C. radioactivity

D. thermionic emission

Answer: B

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3. When ultraviolet rays are incident on a photosensitive metal plate, photoemission is not possible. But it is possible by the incidence of

A. violet rays

B. infrared rays

C. X-rays

D. α- rays

Answer: C

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4. A radiostation broadcasts at frequency of 100 MHz. If the radiating power of the transmitter is 66.6 KW, then the number of photons radiated per second is

[Take $h = 6.66 \times 10^{-34} Js$]

A. 66.6×10^{20}

B. 10^{30}

C. 2×10^{30}

D. 10^{28}

Answer: B

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5. A beam of light of certain intensity and wavelength ejects photoelectrons from a metal surface. This beam is then replaced by another beam of less intensity and smaller wavelength . As a result

A. emission of photoelectrons is stopped

B. no change in intensity and wavelength is produced

C. K.E. of the photoelectrons increases but the photoelectric current decreases

D. K.E. of the photoelectrons decreases but the photoelectric current increases

Answer: C

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6. In the experimental arrangement of photoelectric effect, the metal surface is first illuminated with violet light and then with ultraviolet light and the stopping potential is determined in each case. The stopping potential will

A. be more with violet light

B. be more with ultraviolet light

C. be equal in both cases

D. depend upon the current

Answer: B

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7. Which of the following pairs have linear relationships between themselves when photoelectrons are emitted from a surface ?

A. Intensity of incident radiation and stopping potential

B. Photoelectric current and frequency of incident radiation

C. Photoelectric current and the potential difference between the emitter (cathode) and collector (anode)

D. Frequency of incident radiation and the stopping potential

Answer: D

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8. A photo sensitive surface is receiving light of wavelength 6000 Å at the rate of 10^{-7}J/s . The number of photons striking the surface per second is approximately equal to

A. 1.5×10^{11}

B. 3×10^{11}

C. 4×10^{11}

D. 6×10^{11}

Answer: B

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9. 10 photons each of energy 1.5 eV are made incident on a photosensitive plate whose work function is 3 eV. The number of electrons emitted from the plate will be

A. 10

B. 2

C. Zero

D. 100

Answer: C

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10. When beam of green light is incident on a surface, photo electrons are emitted. If a second beam of different frequency produces photoemission from the same surface, then it may consists of

A. Red light

B. Infrared radiations

C. Ultraviolet radiations

D. Radiowaves

Answer: C

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11. A source S_1 is producing 10^{15} photons/s of wavelength 5000Å Another source S_2 is producing 1.02×10^{15} photons per second of wavelength 5100Å. Then $(\text{power of}$ S_(2))/("power of" S_(1))` is equal to

A. 1

B. 1.1

C. 1.04

D. 0.98

Answer: A

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12. The number of photoelectrons emitted for light of a frequency v (higher than the threshold frequency V_0) is proportional to

A. threshold frequency (v_0)

B. frequency of incident light (v)

C. $v - v_0$

D. intensity of the incident light

Answer: D

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13. A wavelength of a 1 KeV photon is 1.2×10^{-9}m. What is the frequency of 1MeV photon ?

A. $1.25 \times 10^{20} Hz$

B. 1.75×10^{20} Hz

C. 2.5×10^{20}Hz

D. 3.5×10^{19}Hz

Answer: C

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14. The time taken by a photoelectron to come out after the photon strikes is approximately

A. 10^{-16}s

B. 10^{-1}s

C. 10^{-4}s

D. 10^{-10}s

Answer: D

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15. If g_E and g_M are the acceleration due to gravity on the surfaces of the earth and the moon respectively and if Millikan's oil drop

experiment could be performed on the two surfaces, one will find the ratio

electronic charge on the moon/electronic charge on the earth to be

A. 0

B. 1

C. $\frac{g_E}{g_M}$

D. $\frac{g_M}{g_E}$

Answer: B

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16. What is the energy of a photon (in eV), whose frequency is 10^{12}MHz? [$h = 6.63 \times 10^{-34}$]

A. 4.14×10^{3}MeV

B. 4.14×10^{3} eV

C. 4.14×10^{2} eV

D. 4.14×10^{3} KeV

Answer: B

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17. When the intensity of incident light increases, in a photo electric experiment, the

A. kinetic energy of emitted photoelectrons increases

B. photocurrent uncreases

C. kinetic energy of emitted photoelectrons decreases

D. photocurrent decreases

Answer: B

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18. The threshold wavelength for a photosensitive metal plate is 5000 Å. Photoelectrons will be emitted from it if it is irradiated by light from a

A. 50 watt infrared lamp

B. red lamp emitting light wavelength of 7000 Å

C. 25 watt ultraviolet lamp

D. 25 watt infrared lamp

Answer: C

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19. The 22 cm radiowave emitted by hydrogen in interstellar space is due to the interaction called the hyperfine interaction in atomic hydrogen. What is the energy of the emitted wave ?

A. 10^{-25} J

B. $9 \times 10^{-23} J$

C. 9×10^{-25} J

D. $10^{-18} J$

Answer: B

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20. A radio transmitter operates at a frequency of $880kHz$ and a power of $10kW$.

The number of photons emitted per second are

A. 1.5×10^{25}

B. 1.6×10^{30}

C. 1.72×10^{31}

D. 2.8×10^{30}

Answer: C

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21. There are two sources of light, each emitting with a power of $100W$. One emits X-rays of wavelength $1nm$ and the other visible light at $500nm$. Find the ratio of number of photons of X-rays to the photons of visible light of the given wavelength?

A. $\frac{1}{200}$

B. $\frac{1}{300}$

C. $\frac{1}{400}$

D. $\frac{1}{500}$

Answer: D

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22. A red bulb and violet bulb of equal power emits n_R and n_v number of photons in a given time, then

A. $n_R < n_V$

B. $n_R \geq n_V$

C. $n_R > n_V$

D. $n_R = n_V$

Answer: C

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23. Find the wavelength of light that may excite an electron in the valence band of diamond to the conduction band. The energy gap is 5.50 eV

A. 412 nm

B. 352 nm

C. 225 nm

D. 315 nm

Answer: C

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24. A photon of frequency v is incident on a metal surface whose threshold frequency is v_0. The kinetic energy of the emitted photoelectrons will be

A. hv

B. hv_0

C. $h(v + v_0)$

D. $h(v - v_0)$

Answer: D

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25. The energy required to remove an electron from an aluminium surface is 4.2 eV. If two photons, each of energy 3.0 eV, strike an

electron of aluminium, the emission of photoelectrons will

A. be possible

B. not be possible

C. be doubled

D. will decrease

Answer: B

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26. Light of wavelength 4000 Å is incident on a metal surface. The maximum kinetic energy of emitted photoelectron is 2 eV. What is the work function of the metal surface ?

A. 6 eV

B. 4 eV

C. 2 eV

D. 1 eV

Answer: D

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27. Light of wavelengths 400 nanometer and 800 nanometer produces photoemission in two photoemitters. The ratio of the work function of two emitters is

A. $1:4$

B. $1:2$

C. $2:1$

D. $1:3$

Answer: C

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28. Ultraviolet radiation of 6.2 eV falls on a metallic surface. If the work function of the metal is 4.2 eV, then the kinetic energy of the fasted electron ejected from the surface is

A. 1.6×10^{-19} J

B. $3.2 \times 10^{-19} J$

C. 3.2×10^{-25} J

D. $1.6 \times 10^{-18} J$

Answer: B

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29. The work function of a metal is $3.3 \times 10^{-19} J$. The maximum wavelength of the photons required to eject photoelectrons from the metal is (Take $h = 6.6 \times 10^{-34} Js$)

A. 4000 Å

B. 6000 Å

C. 8000 Å

D. 200 Å

Answer: B

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30. The work function of a photoelectric metal is 3.31 eV. If $h = 6.62 \times 10^{-34} Js$, then its threshold frequency will be

A. 8×10^{14} Hz

B. 8×10^{10}Hz

C. 5×10^{15} Hz

D. 3×10^{14} Hz

Answer: A

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31. The maximum kinetic energy of photoelectrons emitted from a surface when

photons of energy 6eV fall on it is 4eV. The stopping potential is:

A. 2 V

B. 4 V

C. 6 V

D. 8 V

Answer: B

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32. The threshold frequency for a photosensitive metal is $3 \times 10^{14} Hz$. The work function of the metal is approximately equal to $\left[h = 6.66 \times 10^{-34} Js\right]$

A. 0.5×10^{-19} J

B. 1.0×10^{-19}J

C. $1.5 \times 10^{-19} J$

D. $2.0 \times 10^{-19} J$

Answer: D

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33. The threshold frequency for a certain metal for photoelectric effect is $1.7x10^{15}Hz$. When light of frequency $2.2 \times 10^{15}Hz$ is incident on the metal surface, the kinetic energy of the emitted photoelectrons is $3.3 \times 10^{-19}J$. What is the value of the Planck's constant ?

A. 3.3×10^{-34} J-s

B. 6.6×10^{-34} J-s

C. 8.6×10^{-34} J-s

D. 4×10^{-35} J-s

Answer: B

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34. 6% of the energy supplied to a 100 watt lamp is radiated as visible light of wavelength 6620 Å. How many quanta are emiited per second ?

A. 10^{19}

B. 2×10^{19}

C. 5×10^{-19}

D. 2×10^{5}

Answer: B

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35. When light of wavelength 3600 nm falls on a photosensitive plate, photoelectrons are emitted. However, for another photoelectric emitter, light of 6000 nm is sufficient to

produce photoemission. What is the ratio of the work functions of the two emitters ?

A. $5:2$

B. $5:4$

C. $5:3$

D. $3:6$

Answer: C

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36. Photons of energy $6eV$ are incident on a metal surface whose work function is $4eV$. The minimum kinetic energy of the emitted photo - electrons will be

A. 1 eV

B. 2 eV

C. zero eV

D. 5 eV

Answer: C

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37. In photoelectric effect experiment, the stopping potential for incident light of wavelength 4000 Å, is 3V. If the wavelength is changed to 2500 Å, the stopping potential will be

A. 3 V

B. more than 3 V

C. less than 3 V

D. Zero volt

Answer: B

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38. What is the stopping potential, when a metal surface with work function 1.2 eV is illuminated with light of energy 3 eV ?

A. 1.8 V

B. 4.2 V

C. 2.1 V

D. 0.8 V

Answer: A

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39. A photon of energy 8 eV is incident on a metal surface of threshold frequency $1.6 \times 10^{15} Hz$. What is the K.E. of the ejected photoelectrons in eV ?

$\left[h = 6 \times 10^{-34} Js\right]$

A. 6 eV

B. 4 eV

C. 2 eV

D. 1 eV

Answer: C

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40. The threshold wavelength of a metal having work function 2 eV is 6000 Å . What will be the threshold wavelength for the metal having a work function of 6 eV ?

A. 3000 Å

B. 2000 Å

C. 8000 Å

D. 18000 Å

Answer: B

41. Photoelectrons of different kinetic energies were emitted from a photosensitive plate, when radiations from a source of variable

frequency were incident on the plate. It was found that for a frequeny of 8×10^{14} Hz, the kinetic energy of the photoelectrons became zero. What was the work function of the plate in eV ? $\left[h = 6.6 \times 10^{-34} Js\right]$

A. 4.3 eV

B. 2.5 eV

C. 3.3 eV

D. 0.5 eV

Answer: C

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42. If light of wavelength 6200Å falls on a photosensitive surface of work function 2 eV, the kinetic energy of the most energetic photoelectron will be

A. 0.5 eV

B. 1 eV

C. zero

D. 0.75 eV

Answer: C

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43. When photons of energy hv fall on a metal plate, having a work function W, the maximum kinetic energy of the ejected photo electrons is K. What will be the maximum K.E. of the ejected photo electrons, from the same plate if the frequency of incident radiation is doubled ?

A. 2 K

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

C. $hv + K$

D. $K = W_0$

Answer: C

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44. Planck's constant has the dimensions of

A. Power

B. P.E.

C. Linear momentum

D. Angular momentum

Answer: D

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45. When zinc is irradiated by radiation of wavelength 3000Å, photo electrons are emitted. If we want to increase the velocity of the emitted photo electrons, then

A. the wavelength of incident radiation should be increased

B. the wavelength of incident radiation should be decreased

C. the intensity of radiation should be increased

D. both the wavelength and the intensity of radiation should be increased

Answer: B

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46. Radiation of energy 6.5 eV is incident on a metal surface whose work function is 4.2 eV. What is the potential difference that should be applied to stop the fastest photoelectrons emitted by the metal surface ?

A. 1.3 V

B. 2.3 V

C. 3.5 V

D. 5.5 V

Answer: B

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47. The threshold frequency for a photosensitive surface corresponds to an energy of 6.5 eV. If the stopping potential for radiations incident on this surface is 3V, then the energy of the incident radiation will be

A. 3.5 eV

B. 7 eV

C. 9.5 eV

D. 13 eV

Answer: C

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48. A photon of energy 7 eV is incident on a metal surface having the work function of 3.75 eV. What is the stopping potential ?

A. 2 V

B. 3 V

C. 3.25 V

D. 4.5 V

Answer: C

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49. Light of frequency 1.5 times the threshold frequency is incident on a photo-sensitive material. If the frequency is halved and the

intensity is doubled, the photoelectric current becomes

A. be doubled

B. be halved

C. be zero

D. increase

Answer: C

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50. Photons of energy 1.5 eV and 2.5 eV are incident on a metal surface of work function 0.5 eV. What is the ratio of the maximum kinetic energy of the photoelectrons ?

A. $1:2$

B. 2

C. 3

D. $1:4$

Answer: A

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51. In photoelectric effect, the work function of a metal is 3.7 eV. The emitted electron can be stopped by applying a potential of 1.8 V. Then

A. the energy of the incident photon is 1.9 eV

B. the energy of the incident photon is 5.5 eV

C. if the energy of the incident photon is 3 eV, then the electron will be emitted

with maximum energy

D. the energy of the incident photon is 11 eV

Answer: B

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52. Einstein's work on photoelectric effect gives support to

A. Mass energy relation

B. Bohr's theory

C. Planck's equation $E = hv$

D. de Broglie's hypothesis

Answer: C

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53. The work function of a metal is 4 eV. What should be the wavelength of the incident radiation for the emission of photoelectrons of zero velocity ?

A. 2500 Å

B. 3100 Å

C. 3500 Å

D. 3800 Å

Answer: B

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54. If Planck's constant is denoted by h and the charge by e, experiments on photoelectric effect allow the determination of

A. only h

B. only e

C. only $\frac{h}{e}$

D. both h and e

Answer: C

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55. In a photoelectric experiment, the wavelength of incident radiation is reduced from 6000 Å to 5000 Å then

A. stopping potential will decrease

B. stopping potential will increase

C. K.E. of emitted electrons will decrease

D. the value of the work function will decrease

Answer: B

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56. A photosensitive surface has work function $W_0 = hv_0$. If photons of energy $2hv_0$ fall on this surface, the electrons are ejected with a maximum velocity of $4 \times 10^6 m/s$. When the energy of the incident photon is increased to $5hv_0$, then maximum velocity of the photoelectrons will be

A. 2×10^7 m/s

B. 8×10^6 m/s

C. 8×10^5 m/s

D. 2×10^6 m/s

Answer: B

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57. Radiation of frequency $v = 9v_0$ is incident on a metal surface, having threshold frequency v_0. The maximum velocity of the ejected photoelectrons is $6 \times 10^6 m/s$. What will be the maximum velocity of the ejected photoelectrons , if v is reduced to $3v_0$?

A. 2×10^6 m/s

B. 3×10^6 m/s

C. 1.5×10^6 m/s

D. 4×10^6 m/s

Answer: B

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58. When a photosensitive surface is illuminated with light of wavelength λ, the stopping potential is V_0. But when light of

wavelength 2λ is incident on the same surface, the stopping potential is $\frac{V_0}{4}$. What is the threshold wavelength for the surface ?

A. 2λ

B. 3λ

C. 4λ

D. 5λ

Answer: B

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59. Dimension's of planck's constant are the same as the dimensions of the product of

A. force, displacement and time

B. force and velocity

C. force and displacement

D. force and time

Answer: A

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60. When light of wavelength 3000 Å falls on a photosensitive surface (A) photoelectrons are emitted. However, for another photoemitter (B), light of wavelength 6000 Å is required for the emission of photoelectrons. What is the ratio of the work functions of A and B ?

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: C

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61. Monochromatic light incident on a metal surface emits electrons with kinetic energies ranging from 0 to 2.5 eV. What is the least energy of the incident photon, if for removing the tightly bound electron from the metal surface an energy of 4.3 eV is required ?

A. 1.8 eV

B. 6.8 eV

C. from 1.8 eV to 6.8 eV

D. 3.4 eV

Answer: B

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62. The work function of a substance is 4.0 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately equal to

A. 540 nm

B. 400 nm

C. 310 nm

D. 220 nm

Answer: C

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63. Radiations of frequencies 8×10^{15} Hz and 5×10^{15} Hz are incident one after the another on the same photosensitive surface. If is found

that the kinetic energies of the photo electrons emitted from the surface are in the ratio of 2:1 . What is the threshold frequency for the surface ?

A. 1.5×10^{15}Hz

B. 2×10^{15} Hz

C. 2.5×10^{15} Hz

D. 3×10^{15}Hz

Answer: B

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64. When photons of energy 5 eV fall on a photosensitive surface, the maximum K.E. of the photoelectrons emitted from the surface is 2.5 eV. What is the stopping potential ?

A. 5 V

B. 2.5 V

C. 7.5 V

D. 1 V

Answer: B

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65. Radiation is incident on a photosensitive surface and the stopping potential is found to be 9 V. What is the maximum velocity of the ejected photo electrons if the specific charge of the electron is 1.8×10^{11} C/kg ?

A. 6.6×10^5 m/s

B. 1.8×10^6 m/s

C. 8×10^6 m/s

D. 12×10^5 m/s

Answer: B

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66. 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. 0.5 eV

B. 0.75 eV

C. 1 eV

D. 1.25 eV

Answer: C

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67. According to Einstein's photoelectric equation, the plot of the maximum kinetic energy of the emitted photoelectrons from a metal versus frequency of the incident radiation gives a straight line whose slope

A. is the same for all metals and independent of the intensity of the radiation

B. depends both on the intensity of the radiation and the metal used

C. depends on the intensity of the radiation

D. depends on the nature of the metal used

Answer: A

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68. Two identical photocathode receive light of frequencies f_1 and f_2. If the maximum velocities of the photoelectrons (of mass m) coming out are respectively v_1 and v_2 then:

A. $v_1^2 - v_2^2 = \frac{2h}{m}(f_1 - f_2)$

B. $v_1 + v_2 = \left[\frac{2h}{m}(f_1 + f_2)\right]^{1/2}$

C. $v_1^2 + v_2^2 = \frac{2h}{m}(f_1 + f_2)$

D. $v_1 - v_2 = \left[\frac{2h}{m}(f_1 - f_2)\right]^{1/2}$

Answer: A

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69. The work functions for metals A, B and C are respectively 1.92 eV, 2.0 eV and 5 eV. According to Einstein's equation the metals which will emit photoelectrons for a radiation of wavelength 4100 Å is/are

A. A only

B. A and B only

C. All the three metals

D. C only

Answer: B

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70. In a photoelectric experiment, a student plotted the graph of stopping potential (Vs) against the frequency of incident radiation (v). But he could not write the unit of the slope of the graph. What is the corrent unit ?

A. J.A.

B. C/J-s

C. J/s/C

D. J/A

Answer: D

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71. X-rays are used to irradiate sodium and copper surfaces in two separate experiments

and stopping potential are determined. The stopping potential is

A. $V_{\mathrm{Na}} > V_{\mathrm{Cu}}$

B. $V_{\mathrm{Na}} = V_{\mathrm{Cu}}$

C. $V_{\mathrm{Na}} < V_{\mathrm{Cu}}$

D. V_{Na} and V_{Cu} are inversely proportional to v

Answer: A

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72. The maximum kinetic energies of photoelectrons emitted from a metal are k_1 and k_2 when it is irradiated with light of wavelenght λ_1 and λ_2 respectively. Find work function of the metal.

A. $\frac{\lambda_1 K_1 + \lambda_2 K_2}{\lambda_1 + \lambda_2}$

B. $\frac{\lambda_1 K_2 + \lambda_2 K_1}{\lambda_1 + \lambda_2}$

C. $\frac{\lambda_1 K_1 - \lambda_2 K_2}{\lambda_2 - \lambda_1}$

D. $\frac{\lambda_1 K_2 - \lambda_2 K_1}{\lambda_1 - \lambda_2}$

Answer: C

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73. Maximum velocity of photoelectrons emitted by a metal surface is $1.2 \times 10^6 m/s$. Assuming the specific charge of the electrons to be $1.8 \times 10^{11} C/kg$ the value of stopping potential in volt will be:

A. 2

B. 3

C. 4

D. 6

Answer: C

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74. By how much would the stopping potential for a given photosensitive surface go up if the frequency of the incident radiations were to be increased from $4 \times 10^{15} Hz$ to $8 \times 10^{15} Hz$? Given, $h = 6.6 \times 10^{-34} Js$, $e = 1.6 \times 10^{-19} C$ and $c = 3 \times 10^{8} ms^{-1}$.

A. 6 V

B. 8 V

C. 12 V

D. 16 V

Answer: D

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75. 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. $\left[\frac{2(h\lambda-\phi)}{m}\right]^{1/2}$

B. $\left[\frac{2(hC-\lambda\phi)}{m\lambda}\right]^{1/2}$

C. $\left[\frac{2(hC+\lambda\phi)}{m\lambda}\right]^{1/2}$

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

Answer: B

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76. 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. $\frac{Kv_1 - v_2}{K - 1}$

B. $\frac{Kv_2 - v_1}{K - 1}$

C. $\frac{v_2 - v_1}{K}$

D. $\frac{v_1 - v_2}{K - 1}$

Answer: A

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77. 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. Visible region

B. X - ray region

C. Ultra-violet region

D. Infra-red region

Answer: C

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78. The maximum velocity of electrons emitted from a metal surface is v. What would be the maximum velocity if the frequency of incident lightis increased by a factor of 4?

A. 2v

B. more than 2v

C. less than 2v

D. between v and 1.5 v

Answer: B

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79. When radiation of wavelength 3000 Å is incident on a photosensitive surface, the maximum K.E. of the photoelectrons is 2.5 eV.

What is the stopping potential if radiation of wavelength 1500 Å is incident on the same surface ?

A. 4.5 V

B. 5.5 V

C. more than 5.5 V but less than 7V

D. less than 5.5 V but more than 4.5 V

Answer: C

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80. Ultraviolet light of wavelength λ_1 and λ_2 (with $\lambda_2 > \lambda_1$) when allowed to fall on hydrogen atoms in their ground state is found to liberate electrons with kinetic energies E_1 and E_2 respectively. The value of the planck's constant can be found from the relation

A. $h = \frac{1}{c}(\lambda_2 - \lambda_1)(E_1 - E_2)$

B. $h = \frac{1}{c}(\lambda_2 + \lambda_1)(E_1 + E_2)$

C. $h = \frac{(E_1 - E_2)\lambda_1\lambda_2}{c(\lambda_2 - \lambda_1)}$

D. $h = \frac{(E_1 + E_2)\lambda_1\lambda_2}{c(\lambda_2 + \lambda_1)}$

Answer: C

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81. Consider a metal exposed to light of wavelength 600nm. The maximum energy of the electrons doubles when light of wavelength 400nm is used. Find the work function in eV.

A. 1.1 ev

B. 1.03 eV

C. 1.5 eV

D. 1.8 eV

Answer: B

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82. 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. 1.3 eV

B. 1.5 eV

C. 0.65 eVs

D. 1.0 eV

Answer: D

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83. When a certain metallic surface is illuminated with mono chromatic light of wavelength λ, the stopping potential for

photoelectric current is $3V_0$. When the same surface is illuminated with light of wavelength 2λ the stopping potential is V_0. The threshold wavelength for this surface for photoelectric effect is.

A. 4λ

B. $\frac{\lambda}{4}$

C. $\frac{\lambda}{6}$

D. 6λ

Answer: A

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84. A photosensitive metallic surface has a work function ϕ . If a photon of energy 3ϕ fall on this surface, the electron is ejected with a maximum velocity of 6×10^6 m/s. When the photon energy is increased to 9ϕ , then the maximum velocity of the ejected photoelectrons will be

A. 12×10^6m/s

B. 24×10^6m/s

C. 3×10^6 m/s

D. 6×10^6 m/s

Answer: A

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85. Silver has a work function of 4.7 eV. When ultraviolet light of wavelength 100 nm is incident upon it, a potential of 7.7 V is required to stop the photo electrons from reaching the collector plate. How much

potential will be required to stop the photoelectrons when light of wavelength 200nm is incident upon silver?

A. 2.35 V

B. 1.5 V

C. 15.4 V

D. 3.85 V

Answer: B

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86. The photoelectric threshold wavelength for silver is λ_0. The energy of the electron ejected from the surface of silver by an incident wavelength $\lambda(\lambda < \lambda_0)$ will be

A. $hc\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)$

B. $hc(\lambda_0 - \lambda)$

C. $\frac{hc}{\lambda_0 - \lambda}$

D. $\frac{h}{c}\left(\frac{\lambda_0 - \lambda}{\lambda\lambda_0}\right)$

Answer: A

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87. 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: D

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88. Light of wavelength λ_A and λ_B falls on two identical metal plates A and B respectively . The maximum kinetic energy of photoelectrons in K_A and K_B respectively , then which one of the following relations is true ? $(\lambda_A = 2\lambda_B)$

A. $K_A < \frac{K_B}{2}$

B. $2K_A = K_B$

C. $K_A = 2K_B$

D. $K_A > 2K_B$

Answer: A

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89. A source of light is placed at a distance of 1 m from a photo cell and the cut off potential is found to be 5 V. If the source is kept at 1.5 m from the cell, then the cut off potential will be

A. 7.5 V

B. 10 V

C. 5 V

D. 3 V

Answer: C

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90. The work function of two photosensitive surfaces A and B are 5 eV and 3 eV. Which surface should be selected to prepare a photo cell which is to be used for visible light ?

A. surface A

B. surface B

C. neither A nor B

D. Both A and B

Answer: B

Watch Video Solution

91. A radio transmitter operates at a frequency of 300 KHz and a power of 10 KW. The number

of photons emitted per second is approximately equal to

A. 7.5×10^{31}

B. 5×10^{31}

C. 2.5×10^{31}

D. 4×10^{31}

Answer: B

Watch Video Solution

92. For a photocell, the work function is ϕ and the stopping potential is V_s . The wavelength of the incident radiation is

A. $\frac{hc}{\phi}$

B. $\frac{hc}{\phi - eV_s}$

C. $\frac{hc}{\phi + eV_s}$

D. $\frac{hc}{e\phi + V_s}$

Answer: C

Watch Video Solution

93. The stopping potential for a certain photocell is 1.2 V when light of wavelength $\lambda_1 = 400$ nm is used. It is 0.6 V, when light of wavelength $\lambda_2 = 500$ nm is used. What would be the stopping potential, when both λ_1 and λ_2 are incident simultaneously ?

A. 0.9 V

B. 1.8 V

C. 0.6 V

D. 1.2 V

Answer: D

Watch Video Solution

94. If 15% of the energy supplied to a bulb is radiated as visible light, how many quanta are emitted per second by a 100 watt lamp ? Assume that the wavelength of visible light is 5600 Å .

A. 2×10^4

B. 1.4×10^{19}

C. 1.4×10^{28}

D. 2.8×10^{19}

Answer: B

Watch Video Solution

95. A photocell is illuminated by a point source of light kept at a distance of 50 cm. If the source is shifted by 50 cm away from the photocell, then

A. energy of each emitted photoelectron will be half of the initial energy

B. energy of each photoelectron will be two times the initial energy

C. number of emitted photoelectrons will be one quarter on the initial number

D. number of emitted photoelectrons will be double the initial number

Answer: C

 Watch Video Solution

96. When an inert gas is filled in the place vacuum in a photo cell , then

A. photoelectric current remains the same

B. decrease or increase in photoelectric current does not depend upon the gas filled

C. photoelectric current is increased

D. photoelectric current is decreased

Answer: C

Watch Video Solution

97. An image of the sun is formed by a lens, of the focal length of 30 cm, on the metal surface of a photoelectric cell and a photoelectric current I is produced. The lens forming the image is then replaced by another of the same diameter but of focal length 15 cm. The photoelectric current in this case is

A. $4I$

B. $2I$

C. $\frac{I}{2}$

D. I

Answer: A

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98. When a monochromatic point source of light is at a distance

of 0.2 m from a photoelectric cell, the cut off

voltage and the saturation current

are respectively 0.6 V and 18.0 mA. If the same source is placed 0.6 m away

from the photoelectric cell, then

(a) the stopping potential will be 0.2 V

(b) the stopping potential will be 0.6 V

(c) the saturation current will be 6.0 mA

(d) the saturation current will be 2.0 mA

A. the saturation current will be 18 mA

B. the saturation current will be 6 mA

C. the stopping potential will be 0.6 V

D. the stopping potential will be 0.2 V

Answer: C

Watch Video Solution

99. Light from a hydrogen tube is incident on the cathode of a photoelectric cell the work function of the cathode surface is $4.2eV$. In order to reduce the photo - current to zero the voltage of the anode relative to the cathode must be made

A. $+9.4\,\mathrm{V}$

B. $-17.8\,\mathrm{V}$

C. $-4.2\,\mathrm{V}$

D. $-9.4\,\mathrm{V}$

Answer: D

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100. Work function of lithium and copper are respectively $2.3eV$ and $4.0eV$. Which one of the metal will be useful for the photoelectric

cell working with visible light ?

$\left(h = 6.6 \times 10^{-34} J - s, c = 3 \times 10^{8} m / s\right)$

A. Copper

B. Lithium

C. Both

D. None of these

Answer: B

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101. If a photon has velocity c and frequency n, then which of following represents its wavelength ?

A. $\frac{hC}{E}$

B. hv

C. $\frac{hv}{C^2}$

D. $\frac{E}{hC}$

Answer: B

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102. A particle which has zero rest mass and non - zero energy and momentum must travel with a speed

A. which is infinite

B. equal to C, the speed of light in vacuum

C. less than C

D. greater than C

Answer: B

 Watch Video Solution

103. The wavelength of the electromagnetic radiations whose photon has energy of 5eV is

A. 5000 A

B. 2486 A

C. 4268 A

D. 3386 A

Answer: B

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104. The energy of a photon corresponding to the visible light of maximum wavelenth is approximately

A. 1 eV

B. 1.6 eV

C. 7 eV

D. 3 eV

Answer: B

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105. For light of a wavelength 4000 Å, the photon energy is 2eV. For X rays of wavelength 1 Å, the photon energy will be

A. 2000 eV

B. 4000 eV

C. 6000 eV

D. 8000 eV

Answer: D

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106. What is the momentum of a photon having frequency of 1.5×10^{13} Hz ?

A. 6.62×10^{-29} kg m/s

B. 3.31×10^{-29} kg m/s

C. 3.31×10^{-34} kg m/s

D. 6.62×10^{-34} kg m/s

Answer: B

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107. There are N_1 photons of frequency v_1, in a beam of light, In another light beam of equal energy there are N_2 photons of frequency v_2. Then N_1 and N_2 are related as

A. $\frac{N_1}{N_2} = 1$

B. $\frac{N_1}{N_2} = \frac{v_1}{v_2}$

C. $\frac{N_1}{N_2} = \frac{v_2}{v_1}$

D. $\frac{N_1}{N_2} = \sqrt{\frac{v_2}{v_1}}$

Answer: C

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108. n_R and n_g give the number of photons in red and green beams of light. If the two beams have the same energy, then

A. $n_R < n_g$

B. $n_R > n_g$

C. $n_R = n_g$

D. $n_R = 0.75 n_g$

Answer: B

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109. The momentum of a photon of electromagnetic radiation is 3.3×10^{-29} kg m/s . The frequency of radiation is $\left[h = 6.6 \times 10^{-34} Js\right]$

A. 2.5×10^{15} Hz

B. 1.5×10^{13} Hz

C. 6×10^{13} Hz

D. 5×10^{15} Hz

Answer: B

Watch Video Solution

110. The wavelength of electromagnetic radiation is doubled. What will happen to the energy of the photons of the new radiation ?

A. E is doubled

B. E becomes four times

C. E is halved

D. The energy will be $1/4^{th}$ of the original energy

Answer: C

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111. The energy of a photon is $E = hv$ and the momentum of photon $p = \frac{h}{\lambda}$, then the velocity of photon will be

A. EP

B. $\frac{E}{P}$

C. $\left(\frac{E}{P}\right)^2$

D. $\left(\frac{P}{E}\right)^2$

Answer: B

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112. What is the momentum of a photon of energy 1 MeV in kg m/s ?

A. 5×10^{-24}

B. 5.1×10^{-22}

C. 7.5×10^{-19}

D. 12×10^{8}

Answer: B

Watch Video Solution

113. Energy from the sun is received on the earth at the rate of $9J/cm^2/$minute. The average wavelength of solar light is taken as 5500 Å. How many photons are received on the earth per cm^2 per minute? $[h = 6.6 \times 10^{-34} J - s]$

A. 2.2×10^{17}

B. 1.8×10^{19}

C. 2.5×10^{19}

D. 1.5×10^{18}

Answer: C

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114. Photon of frequency v has a momentum associated with it. If c is the velocity of light, the momentum is:

A. hvC

B. v/C

C. hv/C^2

D. hv/C

Answer: D

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115. Which one of the following is correct ?

A. $E^2 = p^2c$

B. $E^2 = pc^2$

C. $E^2 = p^2c^2$

D. $E^2 = \frac{p^2}{c^2}$

Answer: C

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116. The curve drawn between velocity and frequency of a photon in vacuum will be

A. Straight line passing through the origin and making an angle of 45° with the frequency axis

B. Straight line parallel to the frequency axis

C. Hyperbola

D. Straight line parallel to the velocity axis

Answer: B

Watch Video Solution

117. A photon of $\lambda = 4400\text{Å}$ is passing through vacuum. What is the mass and momentum of the photon ?

A. 5×10^{-30} kg and 1.5×10^{-25} kg m/s

B. 5×10^{-36} kg and 1.5×10^{-27} kg m/s

C. Zero, 1.5×10^{-26} kg m/s

D. 5×10^{-36} kg and 1.6×10^{-40} kg m/s

Answer: B

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118. If a source of power $4kW$ produces 10^{20} photons / second, the radiation belongs to a part of the spectrum called:

A. γ-rays

B. X-rays

C. Ultraviolet rays

D. Microwaves

Answer: B

Watch Video Solution

119. What is the force exerted by a photon beam of intensity $1.4kW/m^2$, if it falls on a perfectly absorbing disc of radius 4 metre ?

A. $8.35 \times 10^4 N$

B. $10^8 N$

C. $8.8 \times 10^{-8} N$

D. 2.35×10^{-4}N

Answer: D

Watch Video Solution

120. The stopping potential (V_S) against frequency graph of a substance is shown in the figure. The threshold wavelength is

A. 4000 Å

B. 5000 Å

C. 6000 Å

D. 7500 Å

Answer: B

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121. The figure shows the variation of photoelectric current (I) with potential (V) for a photo-sensitive surface for two radiations of frequencies v_a and v_b for the curves a and b respectively. From the graph we find that

A. $v_a = v_b$

B. $v_a > v_b$

C. $v_a < v_b$

D. $v_a = \sqrt{2}v_b$

Answer: A

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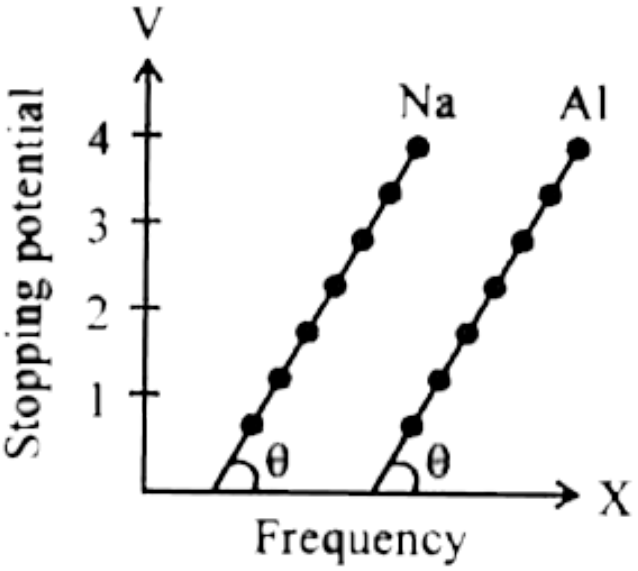
122. From the graph of stopping potential against frequency for Na and Al, we infer that



A. Al is a better photosensitive material than Na

B. The stopping potentials are different for Na and Al for the same change in frequency

C. Maximum kinetic energy for both the metals vary linearly with the frequency

D. Na and Al both have the same threshold frequency

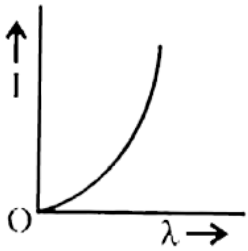
Answer: C

View Text Solution

123. The anode vollage of a photocell is kept fixed . The wavelength $\lambda$of the light falling on the cathode varies as follows

A. 

B.

C. 

D.

Answer: D

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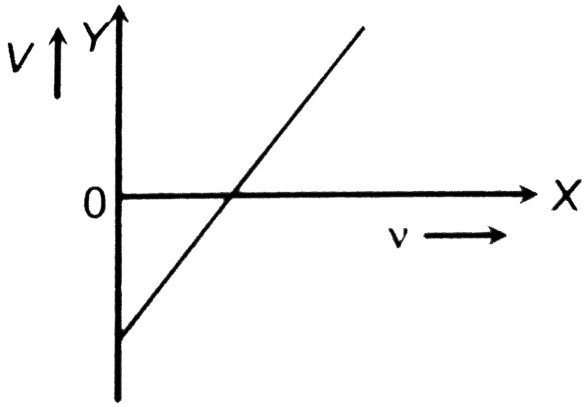
124. The stopping potential V for photoelectric emission from a metal surface is plotted along Y - axis and frequency v of incident light along X - axis . A straight line is obtained as shown . Planck's constant is given by



A. Slope of the straight line

B. Product of the intercept along the X-axis and the mass of the electron

C. Product of the slope of the line and the charge on the electron

D. Intercept on the Y-axis divided by the charge on the electron

Answer: C

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125. A graph of the kinetic energy (K) of the photoelectrons (in eV) against the frequency (v) for a metal used as a cathode in a photoelectric experiment is as shown in the figure .

What is the work function of the metal ?

A. 2 eV

B. 2.5 eV

C. 3 eV

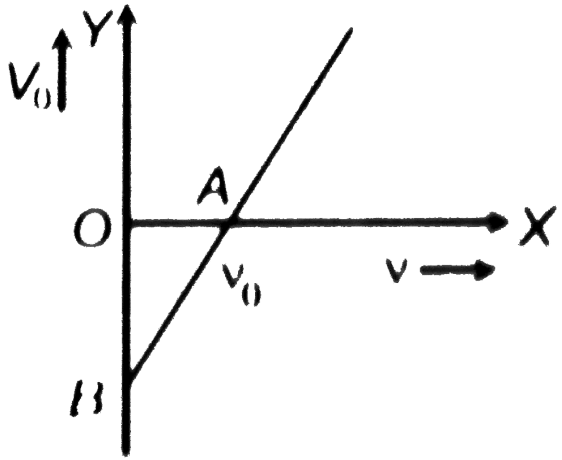
D. 4 eV

Answer: C

View Text Solution

126. In an experiment on photoelectric effect the frequency f of the incident light is plotted against the stopping potential V_0. The work function of the photoelectric surface si given

by (e is the electronic charge)



A. OB $\times$ e in eV

B. OB in volt

C. OA in eV

D. the slope of the line AB

Answer: A

Watch Video Solution

127. The figure shows the variation of photoelectric current with anode potential for a photo-sensitive surface for three different radiations. Let I_a, I_b and I_c be the intensities and f_a, f_b and f_c be the frequencies for the curves a, b and c respectively then

A. $f_a = f_b$ and $I_a \neq I_b$

B. $f_a = f_c$ and $I_a = I_c$

C. $f_a = f_b$ and $I_a = I_b$

D. $f_a = f_b$ and $I_a = I_b$

Answer: A

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128. The following figure represents the graph of photoelectric current I versus applied voltage (V). What is the maximum energy of the emitted photoelectrons ?

A. 4 eV

B. 0 eV

C. 4 J

D. 2 eV

Answer: A

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129. According to Einstein's photoelectric equation, the graph between kinetic energy of

photoelectrons ejected and the frequency of the incident radiation is :

A. 

B. 

C. 

D. 

Answer: D

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130. The graph of photoelectric current (i) verses the applied voltage is (V) is as shown in the figure. What is the maximum energy of the emitted photoelectrons ?

A. 0 eV

B. 2 eV

C. 3 eV

D. 5 eV

Answer: D

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131. When radiations of wavelength λ_1 and λ_2 are incident on certain photosensitive material, the energies of electron ejected ar E_1 and E_2 respectively, such that $E_1 > E_2$, Then Planck's constant 'h' is (C = velocity of light)

A. $\frac{(E_1 - E_2)(\lambda_1 - \lambda_2)}{c(\lambda_1 \cdot \lambda_2)}$

B. $\frac{(E_1 - E_2)\lambda_1 c}{(\lambda_1 - \lambda_2)\lambda_2}$

C. $\frac{(E_1 - E_2)\lambda_1\lambda_2}{c(\lambda_2 - \lambda_1)}$

D. $\frac{(\lambda_2 - \lambda_1)c}{(E_1 - E_2)\lambda_1 \cdot \lambda_2}$

Answer: C

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132. Let P and E denote the linear momentum and energy of emitted photon respectively. If the wavelength of incident radiation is increased, then

A. both p and E increase

B. p increases and E decreases

C. p decreases and E increases

D. both p and E decrease

Answer: D

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133. The frequency of incident light falling on a photosensitive metal plate is doubled, the K.E of the emitted photo-electrons is

A. same as its initial value

B. two times its initial value

C. more than two times its initial value

D. less than two times its initial value

Answer: C

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134. The number of photoelectrons emitted from a photosensitive surface

A. varies inversely witht the frequency of radiation

B. varies directly with the frequency of radiation

C. varies inversely with the intensity of radiation

D. varies directly with the intensity of radiation

Answer: D

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135. The energy of a photon of wavelength λ is [h = Planck's constant, c = speed of light in vacuum]

A. $hc\lambda$

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

C. $\frac{\lambda}{hc}$

D. $\frac{hc}{\lambda}$

Answer: D

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136. Light of wavelength A which is less than threshold wavelength is incident on a photosensitive material. If incident wavelength is decreased so that emitted photoelectrons are moving with same velocity, then stopping potential will

A. increase

B. decrease

C. be zero

D. become exactly half

Answer: A

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137. When light of wavelength λ is incident on photosensitive surface, the stopping potential is V. When light of wavelength 3λ is incident on same surface, the stopping potential is $\frac{V}{6}$ Thereshould wave length for the surface is

A. 2λ

B. 3λ

C. 4λ

D. 5λ

Answer: D

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138. On a photosensitive material, when frequency of incident radiation is increased by 30% kinetic energy of emitted photoelectrons

increases from $0.4eV$ to $0.9eV$. The work function of the surface is

A. 1 eV

B. 1.267 eV

C. 1.4 eV

D. 1.8 eV

Answer: B

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Test Your Grasp 17

1. The energy of a photon of wavelength 4000 Å is

(use $h = 6.66 \times 10^{-34}$J-s)

A. 2×10^{-19} J

B. 3×10^{-19}J

C. 4×10^{-19}J

D. 5×10^{-19}J

Answer: D

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2. In a photoelectric experiment, the reciprocal of the slope of the straight line graph giving the relation between the stopping potential and the frequency of incident radiation gives

A. h

B. e

C. $\frac{h}{e}$

D. $\frac{e}{h}$

Answer: D

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3. The momentum of a photon of an electromagnetic radiation is 3.3×10^{-29} kg m/sec. What is the frequency of the associated waves ? [$h = 6.6 \times 10^{-34}$ J-s]

A. 3×10^{10} Hz

B. 1.5×10^{13}Hz

C. 4.5×10^{13}Hz

D. $6 \times 10^{10} Hz$

Answer: B

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4. If the threshold frequency for photoemission on a metal corresponds to a wavelength 5000 Å, then its work function is

A. 10 J

B. 16×10^{-14}J

C. 4×10^{-10}J

D. 4×10^{-19}J

Answer: D

 Watch Video Solution

5. Photons of energy 5.5 eV are incident on a metal surface. If the stopping potential is 3V, then the work function of the metal will be

A. 2.5 eV

B. 2 eV

C. 8.5 eV

D. 1.5 eV

Answer: A

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6. When light of energy 2.5 eV falls on a metal surface, the maximum K.E. of the emitted electrons is T. If the radiation of energy 4eV is made incident on the same metal surface, the K.E. of the electrons is doubled. What is the work function of the metal ?

A. 0.5 eV

B. 1 eV

C. 1.5 eV

D. 2 eV

Answer: B

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7. The threshold energy of a surface is 2 eV. When irradiated with some radiations, the stopping potential is found to be 3.6 V. The energy of the incident photon is

A. 4.48×10^{-19}J

B. 8.96×10^{-19}J

C. 15×10^{-18}J

D. 17.92×10^{-19}J

Answer: B

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8. Sodium and copper have work functions of 2.3 eV and 4.5 eV. The ratio of their

corresponding threshold wavelengths will be approximately equal to

A. $2:1$

B. $1:2$

C. $\sqrt{2}:1$

D. $1:4$

Answer: A

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9. The surface of a metal is illuminated with light of wavelength 400 nm. The kinetic energy of the ejected photoelectrons was found to be 1.68 eV. What is the work function of the metal ? [$hC = 1240eV \cdot nm$]

A. 3.09 eV

B. 1.41 eV

C. 1.51 eV

D. 1.68 eV

Answer: B

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10. The current in a photocell can be just reduced to zero by a potential of 2.5 V. The maximum kinetic energy of the emitted electrons is

A. 2 J

B. 2.5 eV

C. 4 eV

D. 4×10^{-19} J

Answer: B

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11. A lamp is placed at a distance of 8 cm from a photocell and the microammeter records a current of $100\mu A$. If the lamp is kept at a distance of 4 cm from the photocell, the photoelectric current recorded by the microammeter will be

A. $200\mu A$

B. $400\mu A$

C. $100\mu A$

D. $300\mu A$

Answer: B

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

other conditions remaining unchanged , then

(assuming $hv > W_2$)

A. $I_1 < I_2 < 2I_1$

B. $I_1 > I_2$

C. $I_1 < I_2$

D. $I_1 = I_2$

Answer: D

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13. The wavelength of the photons are 4500 Å and 6000 Å. The ratio of their energies is

A. $1:2$

B. $3:4$

C. $4:3$

D. $2:5$

Answer: C

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14. An AIR station is broadcasting the waves of wavelength $300 metres$. If the radiating power of the transmitter is $10 kW$, then the number of photons radiated per second is

A. 1.5×10^{25}

B. 1.5×10^{31}

C. 1.5×10^{33}

D. 1.5×10^{35}

Answer: B

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15. For a photosensitive metal surface the graph of the stopping potential V_0 against frequency v of the incident radiation is as shown in the figure. What is the work function of the metal ? $[h = 6.6 \times 10^{-34} J \cdot s]$

A. 15.5 eV

B. 17.8 eV

C. 20.6 eV

D. 24.5 eV

Answer: C

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