PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

DUAL NATURE OF RADIATION AND MATTER

De Broglie Hypothesis

1. Dual nature of radiation is shown by

A. Diffraction and reflection

B. Refraction and diffraction

C. Photoelectric effect alone

D. Photoelectric effect and diffraction

Answer: D

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2. The de - Broglie wavelength λ

A. is proportional to mass

B. is inversely to mass

C. Inversely proportional to linear momentum

D. does not depend on linear momentum

Answer: C

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3. An electron and a photon have the same de Broglie wavelength. Which one of these has higher kinetic energy?

A. Can not determined

B. Proton has more K.E than Electron

C. Both have same K.E

D. Electron has more K.E than Proton

Answer: D

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4. If particles are moving with same velocity, then maximum de - Broglie wavelength will be for

A. Neutron

B. Proton

C. β- particle

D. α - particle

Answer: C

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5. If an electron and a photon propagate in the form of waves having the same wavelength , it implies that they have the same

A. Energy

B. Momentum

C. Velocity

D. Angular momentum

Answer: B

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6. Particle nature and wave nature of electromagnetic waves and electrons can be shown by

A. Electron has small mass, deflected by the metal sheet

B. X - ray is diffracted, reflected by thick metal sheet

C. Light is refracted and diffracted

D. Photoelectricity and electron microscopy

Answer: D

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7. The de - Broglie wavelength associated with the particle of mass m moving with velocity v is

A. h/mv

B. mv/h

C. $h/2v$

D. m/hv

Answer: A

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

A. Equal to c, the speed of light in vacuum

B. Greater than c

C. Less than c

D. Tending to infinity

Answer: A

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9. When the kinetic energy of an electron is increased , the wavelength of the associated wave will

A. Increase

B. Decrease

C. Wavelength does depend on the kinetic energy

D. None of the above

Answer: A

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10. If the de - Broglie wavelengths for a proton and for an α - particle is equal , then what is the ratio of velocities for proton and alpha particle?

A. $4:1$

B. $2:1$

C. $1:2$

D. $1:4$

Answer: A

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11. According to de - Broglie , the de - Broglie wavelength for electron in an orbit of hydrogen atom is $10^{-9}m$. The principle quantum number for this electron is

A. 1

B. 2

C. 3

D. 4

Answer: C

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12. The kinetic energy of electron and proton is $10^{-32}J$. Then the relation between their de - Broglie wavelength is

A. $\lambda_p < \lambda_e$

B. $\lambda_p > \lambda_e$

C. $\lambda_p = \lambda_e$

D. $\lambda_p = 2\lambda_e$

Answer: A

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13. A photon , an electron and a uranium nucleus all have the same wavelength . The one with the most energy

A. is the photon

B. is the electron

C. is the uranium nucleus

D. depends upon the wavelength and the properties of the particle

Answer: A

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14. The de - Broglie wavelength λ associated with an electron having kinetic energy E is given by the expression

A. $\frac{h}{\sqrt{2mE}}$

B. $\frac{2h}{mE}$

C. $2mhE$

D. $\frac{2\sqrt{2mE}}{h}$

Answer: A

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15. For the Bohr's first orbit of circumference $2\pi r$, the de - Broglie wavelength of revolving electron will be

A. $2\pi r$

B. πr

C. $\frac{1}{2\pi r}$

D. $\frac{1}{4\pi r}$

Answer: A

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16. An electron of mass m when accelerated through a potential difference V has de - Broglie wavelength λ. The de - Broglie wavelength associated with a proton of mass M accelerated through the same potential difference will be

A. $\lambda\frac{m}{M}$

B. $\lambda\sqrt{\frac{m}{M}}$

C. $\lambda\frac{M}{m}$

D. $\lambda\sqrt{\frac{M}{m}}$

Answer: B

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17. What will be the ratio of de - Broglie wavelengths of proton and α - particle of same energy ?

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18. What is the de - Broglie wavelength of the alpha - particle accelerated through a potential difference V?

A. $\frac{0.287}{\sqrt{V}}\text{Å}$

B. $\frac{12.27}{\sqrt{V}}\text{Å}$

C. $\frac{0.101}{\sqrt{V}}\text{Å}$

D. $\frac{0.202}{\sqrt{V}}\text{Å}$

Answer: C

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19. The de - Broglie wavelength of an electron having $80ev$ of energy is nearly

$\left(1eV = 1.6 \times 10^{-19}J,\ \text{Mass of electron } = 9 \times 10^{-31}kg\ \text{Plank's constant } = 6.6 \times 10^{-34}J - \sec\right)$

A. 140Å

B. 0.14Å

C. 14Å

D. 1.4Å

Answer: D

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20. The de - Broglie wavelength of a particle moving with a velocity $2.25 \times 10^8 m/s$ is equal to the wavelength of photon. The ratio of kinetic energy of the particle to the energy of the photon is (velocity of light is $3 \times 10^8 m/s$

A. $1/8$

B. $3/8$

C. $5/8$

D. $7/8$

Answer: B

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21. The speed of an electron having a wavelength of $10^{-10}m$ is

A. $7.25 \times 10^6 m/s$

B. $6.26 \times 10^6 m/s$

C. $5.25 \times 10^6 m/s$

D. $4.24 \times 10^6 m/s$

Answer: A

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22. The de - Broglie wavelength of a particle accelerated with $150vo <$ "potential is" $10^{-10}m.$ If it is accelerated by $600vo < sp.\, d.,$ its wavelength will be

A. 0.25Å

B. 0.5Å

C. 1.5Å

D. 2Å

Answer: B

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23. The de - Broglie wavelength associated with a hydrogen molecule moving with a thermal velocity of $3km\,/\,s$ will be

A. 1Å

B. $0.66Å$

C. $6.6Å$

D. $66Å$

Answer: B

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24. The de - Broglie wavelength of a neutron at $27^\circ C$ is λ. What will be its wavelength at $927^\circ C$?

A. $\lambda/2$

B. $\lambda/3$

C. $\lambda/4$

D. $\lambda/9$

Answer: A

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25. Photon and electron are given same energy $\left(10^{-20}J\right)$. Wavelength associated with photon and electron are λ_{ph} and λ_{el} then correct statement will be

A. $\lambda_{ph} > \lambda_{el}$

B. $\lambda_{ph} < \lambda_{el}$

C. $\lambda_{ph} = \lambda_{el}$

D. $\frac{\lambda_{el}}{\lambda_{ph}} = C$

Answer: A

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26. The kinetic energy of an electron with de - Broglie wavelength of $0.3nanometre$ is

A. $0.168eV$

B. $16.8eV$

C. $1.68eV$

D. $2.5eV$

Answer: A

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27. A proton and and α- particle are accelerated through a potential difference of $100V$. The ratio of the wavelength associated with the proton to that associated with an α - particle is

A. $\sqrt{2}:1$

B. $2:1$

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

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

Answer: C

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28. The wavelength of de - Broglie wave is $2\mu m$, then its momentum is $\left(h = 6.63 \times 10^{-34 J - s}\right.$

A. $3.315 \times 10^{-28} kg - m / s$

B. $1.66 \times 10^{-28} kg - m / s$

C. $4.97 \times 10^{-28} kg - m / s$

D. $9.9 \times 10^{-28} kg - m / s$

Answer: A

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29. de - Broglie wavelength of a body of mass $1kg$ moving with velocity of $2000 m / s$ is

A. $3.32 \times 10^{-27} Å$

B. $1.5 \times 10^{7}\text{Å}$

C. $0.55 \times 10^{-22}\text{Å}$

D. None of these

Answer: A

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30. The kinetic energy of an electron is $5eV$. Calculate the de - Broglie wavelength associated with it $\left(h = 6.6 \times 10^{-34} Js, m_e = 9.1 \times 10^{-31} kg\right)$

A. 5.47Å

B. 109Å

C. 2.7Å

D. None of these

Answer: A

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

A. 100Å

B. 123Å

C. 1.23Å

D. 0.123Å

Answer: C

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32. Davisson and Germer experiment proved

A. Wave nature of light

B. Particle nature of light

C. Both (a) and (b)

D. Neither (a) nor (b)

Answer: D

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33. The energy that should be added to an electron to reduce its de - Broglie wavelength from one $nm \rightarrow 0.5nm$ is

A. Four times the initial energy

B. Equal to the initial energy

C. Twice the initial energy

D. Thrice the initial energy

Answer: D

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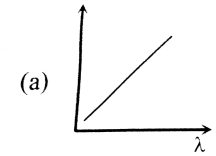
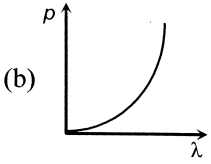
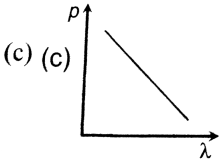
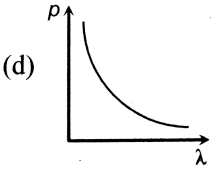
34. Which of the following figure represents the variation of particle momentum and the associated de - Broglie wavelength ?

A. 

B. 

C. 

D. 

Answer: D

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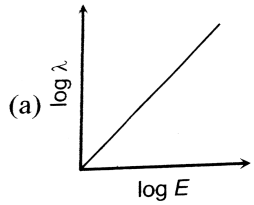
35. The log - log graph between the energy E of an electron and its de - Broglie wavelength λ will be

A.



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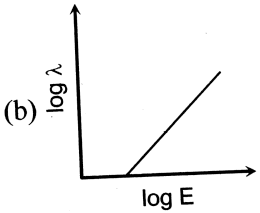
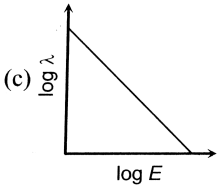
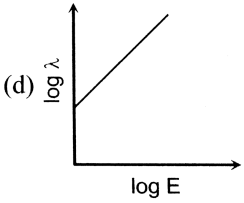


C.



D.



Answer: C

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Photo Momentum Energy

1. The momentum of a photon is $33 \times 10^{-29} kg - m/\sec$. Its frequency will be

A. $3 \times 10^{3} Hz$

B. $6 \times 10^{3} Hz$

C. $7.5 \times 10^{12} Hz$

D. $1.5 \times 10^{13} Hz$

Answer: D

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2. The momentum of a photon is $2 \times 10^{-16} gm - cm/\sec$. Its energy is

A. $0.61 \times 10^{-26} erg$

B. $2.0 \times 10^{-26} erg$

C. $6 \times 10^{-6} erg$

D. $6 \times 10^{-8} erg$

Answer: C

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3. The momentum of the photon of wavelength 5000Å will be

A. $1.3 \times 10^{-27} kg - m/\sec$

B. $1.3 \times 10^{-28} kg - m/\sec$

C. $4 \times 10^{29} kg - m/\sec$

D. $4 \times 10^{-18} kg - m/\sec$

Answer: A

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4. 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^{29}

B. 1.5×10^{31}

C. 1.5×10^{33}

D. 1.5×10^{35}

Answer: B

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5. 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. E/p

B. Ep

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

D. $3 \times 10^8 m/s$

Answer: A

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6. The approximate wavelength of a photon of energy $2.48eV$ is

A. $500Å$

B. $5000Å$

C. $2000Å$

D. $1000Å$

Answer: B

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7. The momentum of a photon in an X - ray beam of $10^{-10} metre$ wavelength is

A. $1.5 \times 10^{-23} kg - m/\sec$

B. $6.6 \times 10^{-24} kg - m/\sec$

C. $6.6 \times 10^{-44} kg - m/\sec$

D. $2.2 \times 10^{-52} kg - m/\sec$

Answer: B

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8. The energy of a photon of light with wavelength 5000Å is approximately $2.5eV$. This way the energy of an X - ray photon with wavelength 1Å would be

A. $2.5/5000eV$

B. $2.5/(5000)^2 eV$

C. $2.5 \times 5000eV$

D. $2.5 \times (5000)^2 eV$

Answer: C

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9. Energy of an quanta of frequency $10^{15} Hz$ and $h = 6.6 \times 10^{-34} J - \sec$ will be

A. $6.6 \times 10^{-19} J$

B. $6.6 \times 10^{-12} J$

C. $6.6 \times 10^{-49} J$

D. $6.6 \times 10^{-41} J$

Answer: A

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10. Momentum of a photon of wavelength λ is

A. $\frac{h}{\lambda}$

B. Zero

C. $\frac{h\lambda}{c^2}$

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

Answer: A

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11. Wavelength of a $1keV$ photon is $1.24 \times 10^{-9}m$. What is the frequency of $1MeV$ photon ?

A. $1.24 \times 10^{15}Hz$

B. $2.4 \times 10^{20}Hz$

C. $1.24 \times 10^{18}Hz$

D. $2.4 \times 10^{23}Hz$

Answer: B

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12. What is the momentum of a photon having frequency $1.5 \times 10^{13} Hz$?

A. $3.3 \times 10^{-29} kgm/s$

B. $3.3 \times 10^{-24} kgm/s$

C. $6.6 \times 10^{-34} kgm/s$

D. $6.6 \times 10^{-30} kgm/s$

Answer: A

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13. Which of the following statements is not correct?

A. Photographic plates are sensitive to infrared rays

B. Photographic plates are sensitive to infrared rays

C. Infra - red rays are invisible but can cast shadows like visible light

D. Infrared photons have more energy than photons of visible light

Answer: B

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14. If we express the energy of a photon in KeV and the wavelength in angstroms , then energy of a photon can be calculated from the relation

A. $E = 12.4hv$

B. $E = 12.4h/\lambda$

C. $E = 12.4/\lambda$

D. $E = hv$

Answer: C

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15. The frequency of a photon , having energy $100eVis\left(h = 6.610^{-34}J - \sec\right)$

A. $2.42 \times 10^{26}Hz$

B. $2.42 \times 10^{16}Hz$

C. $2.42 \times 10^{12}Hz$

D. $2.42 \times 10^{9}Hz$

Answer: B

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16. A photon of wavelength 4400Å is passing through vaccum. The effective mass and momentum of the photon are respectively

A. $5 \times 10^{-36}kg, 1.5 \times 10^{-27}kg - m/s$

B. $5 \times 10^{-35}kg, 1.5 \times 10^{-26}kg - m/s$

C. Zero , $1.5 \times 10^{-26} kg - m/s$

D. $5 \times 10^{-36} kg$, $1.67 \times 10^{-43} kg - m/s$

Answer: A

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17. A radio transmitter operates at a frequency of $880 kHz$ and a power of $10 kW$. The number of photons emitted per second are

A. 1.72×10^{31}

B. 1327×10^{34}

C. 13.27×10^{34}

D. 0.075×10^{-34}

Answer: A

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18. Energy of photon whose frequency is $10^{12} MHz$, will be

A. $4.14 \times 10^3 keV$

B. $4.14 \times 10^2 eV$

C. $4.14 \times 10^3 MeV$

D. $4.14 \times 10^3 eV$

Answer: D

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19. There are n_1 photons of frequency γ_1 in a beam of light . In an equally energentic beam , there are n_2 photons of frequency γ_2. Then the correct relation is

A. $\frac{n_1}{n_2} = 1$

B. $\frac{n_1}{n_2} = \frac{\gamma_1}{\gamma_2}$

C. $\frac{n_1}{n_2} = \frac{\gamma_2}{\gamma_1}$

D. $\frac{n_1}{n_2} = \frac{\gamma_1^2}{\gamma_2^2}$

Answer: C

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20. If mean wavelength of light radiated by $100W$ lamp is 5000Å , then number of photons radiated per second are

A. 3×10^{23}

B. 2.5×10^{22}

C. 2.5×10^{20}

D. 5×10^{17}

Answer: C

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21. When wavelength of incident photon is decreased then

A. Velocity of emitted photo - electron decreases

B. Velocity of emitted photo - electron increases

C. Velocity of photo-electron do not change

D. Photo electric current increases

Answer: B

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22. If the energy of a photon corresponding to a wavelength of $6000Åis3.32 \times 10^{-19}J$, the photon energy for a wavelength of $4000Å$ will be

A. $1.4eV$

B. $4.9eV$

C. $3.1eV$

D. $1.6eV$

Answer: C

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23. If the wavelength of light is 4000Å, then the number of waves in $1mm$ length will be

A. 25

B. 0.25

C. 2.5

D. 25×10^4

Answer: C

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24. If the energy of the photon is increased by a factor of 4 , then its momentum

A. Does not change

B. Decreases by a factor of 4

C. Increases by a factor of 4

D. Decreases by a factor of 2

Answer: C

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25. The ratio of the energy of a photon with $\lambda = 150m$ to that with $\lambda = 300m$ is

A. 2

B. $1/4$

C. 4

D. $1/2$

Answer: A

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26. The minimum wavelength of photon is 5000Å , its energy will be

A. $2.5eV$

B. $50V$

C. $5.48eV$

D. $7.48eV$

Answer: A

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27. A caesium photocell, with a steady potential difference of $60V$ across, is illuminated by a bright point source of light $50cm$ away. When the same light is placed $1m$ away, the photoelectrons emitted from the cell

A. Are one quarter as numerous

B. Are half as numerous

C. Each carry one quarter of their previous momentum

D. Each carry one quarter of their previous energy

Answer: A

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28. A radio transmitter radiates $1kW$ power at a wavelength $198.6m$. How many photons does it emit per second ?

A. 10^{10}

B. 10^{20}

C. 10^{30}

D. 10^{40}

Answer: C

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29. The number of photons of wavelength $540nm$ emitted per second by an electric bulb of power $100W$ is (taking $h = 6 \times 10^{-34}$ sec)

A. 100

B. 1000

C. 3×10^{20}

D. 3×10^{18}

Answer: C

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30. The minimum intensity of light to be detected by human eye is $10^{-10}W/m^2$. The number of photons of wavelength $5.6 \times 10^{-7}m$ entering the eye , with pupil area $10^{-6}m^2$, per second for vision will be nearly

A. 100

B. 200

C. 300

D. 400

Answer: C

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Photo Electric Effect

1. The number of photo - electrons emitted per second from a metal surface increases when

A. The energy of incident photons increases

B. The frequency of incident light increases

C. The wavelength of the incident light increases

D. The intensity of the incident light increases

Answer: D

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2. As the intensity of incident light increases

A. Photoelectric current increases

B. Photoelectric current decreases

C. Kinetic energy of emitted photoelectrons increases

D. Kinetic energy of emitted photoelectrons decreases

Answer: A

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3. Kinetic energy with which the electrons are emitted from the metal surface due to photoelectric effect is

A. Independent of the intensity of illumination

B. Independent of the frequency of light

C. Inversely proportional to the intensity of illumination

D. Directly proportional to the intensity of illumination

Answer: A

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4. The work function of aluminium is $4.2eV$. If two photons , each of energy $3.5eV$ strike an electron of aluminium , then emission of electrons will be

A. Possible

B. Not possible

C. Data is incomplete

D. Depend upon the density of the surface

Answer: B

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5. In photoelectric effect if the intensity of light is doubled then maximum kinetic energy of photoelectrons will become

A. Double

B. Half

C. Four time

D. No change

Answer: D

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6. 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. $I_1 = I_2$

B. $I_1 < I_2$

C. $I_1 > I_2$

D. $I_1 < I_2 < 2I_1$

Answer: A

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7. A beam of light of wavelength λ and with illumination L falls on a clean surface of sodium . If N photoelectrons are emitted each with kinetic energy E , then

A. $N \propto L$ and $E \propto L$

B. $N \propto L$ and $E \propto \frac{1}{\lambda}$

C. $N \propto \lambda$ and $E \propto L$

D. $N \propto \frac{1}{\lambda}$ and $E \propto \frac{1}{L}$

Answer: B

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8. Which of the following statements is correct ?

A. The current in a photocell increases with increasing frequency of light

B. The photocurrent is proportional to applied voltage

C. The photocurrent increases with increasing intensity of light

D. The stopping potential increases with increasing intensity of incident light

Answer: C

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9. The stopping potential (V_0)

A. Depends upon the angle of incident light

B. Depends upon the intensity of incident light

C. Depends upon the surface nature of the substance

D. Is independent of the intensity of the incident light

Answer: D

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10. If intensity of incident light is increased in photo electric effect then which of the following is true ?

A. Maximum $K.E.$ of ejected electron will increase

B. Work function will remain unchanged

C. Stopping potential will decrease

D. Maximum $K.E.$ of ejected electron will decrease

Answer: B

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11. The retarding potential for having zero photo - electron current

A. Is proportional to the wavelength of incident light

B. Increases uniformly with the increase in the wavelength of incident light

C. Is proportional to the frequency of incident light

D. Increases uniformly with the increase in the frequency of incident light wave

Answer: D

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12. A photo cell is receiving light from a source placed at a distance of $1m$. If the same source is to be placed at a distance of $2m$, then the ejected electron

A. Moves with one - fourth energy as that of the initial energy

B. Moves with one - fourth of momentum as that of the initial momentum

C.

D.

Answer: D

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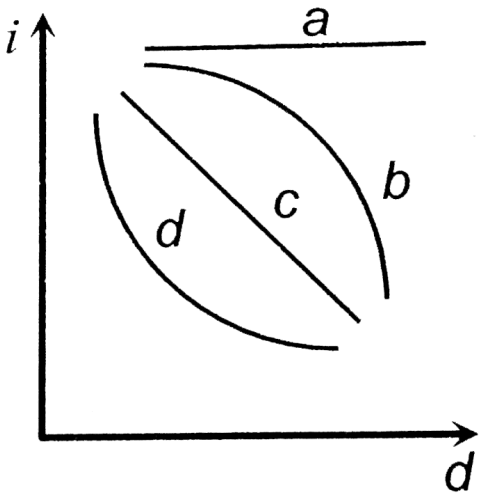
13. A point source of light is used in an experiment on photoelectric effect . Which of the following curves best represents the variation of photo current (i) with distance (d) of the source from the emitter?



A. a

B. b

C. c

D. d

Answer: D

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14. A photon energy $3.4eV$ is incident on a metal having work function $2eV$. The maximum $K.E.$ of photoelectrons is equal to

A. $1.4eV$

B. $1.7eV$

C. $5.4eV$

D. $6.8eV$

Answer: A

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15. 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. $0eV$

B. $1eV$

C. $2eV$

D. $10eV$

Answer: A

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16. A metal surface of work function $1.07eV$ is irradiated with light of wavelength $332nm$. The retarding potential required to stop the escape of photo - electrons is

A. $4.81eV$

B. $3.74eV$

C. $2.66eV$

D. $1.07eV$

Answer: C

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17. When light falls on a metal surface , the maximum kinetic energy of the emitted photo - electrons depends upon

A. The time for which light falls on the metal

B. Frequency of the incident light

C. Intensity of the incident light

D. Velocity of the incident light

Answer: B

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18. The work function of metal is $1eV$. Light of wavelength 3000Å is incident on this metal surface . The velocity of emitted photo - electrons will be

A. $10m/\sec$

B. $1 \times 10^3 m/\sec$

C. $1 \times 10^4 m/\sec$

D. $1 \times 10^6 m/\sec$

Answer: D

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19. Threshold frequency for a metal is $10^{15} Hz$. Light of $\lambda = 4000\text{Å}$ falls on its surface . Which of the following statements is correct ?

A. No photoelectric emission takes place

B. Photo - electrons come out with zero speed

C. Photo - electrons come out with $10^3 m/\sec$ speed

D. Photo - electrons come out with $10^5 m/\sec$ speed

Answer: A

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20. If in a photoelectric experiment , the wavelength of incident radiation is reduced from $6000\text{Å} \rightarrow 4000\text{Å}$ then

A. Stopping potential will decrease

B. Stopping potential will increase

C. Kinetic energy of emitted electrons will decrease

D. The valuer of work function will decrease

Answer: B

Watch Video Solution

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

A. 4125Å

B. 2062.5Å

C. 3000Å

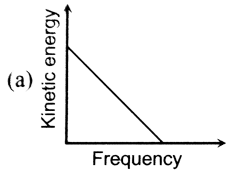
D. 6000Å

Answer: C

Watch Video Solution

22. According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is

A.



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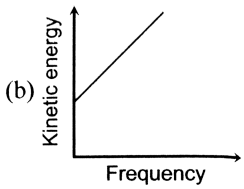

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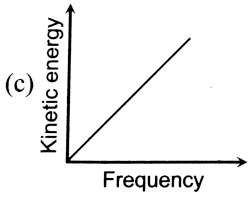
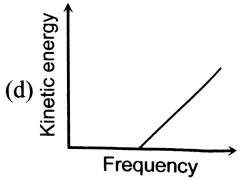


D.



Answer: D

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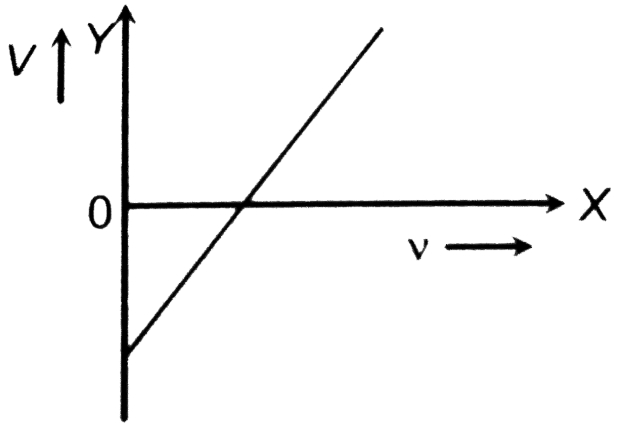
23. The stopping potential V for photoelectric emission from a metal surface is plotted along Y - axis and frequency v of incident light along X -

axis . A straight line is obtained as shown . Planck's constant is given by



A. Slope of the line

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

C. Product of intercept along Y - axis and mass of the electron

D. Product of Slope and mass of electron

Answer: B

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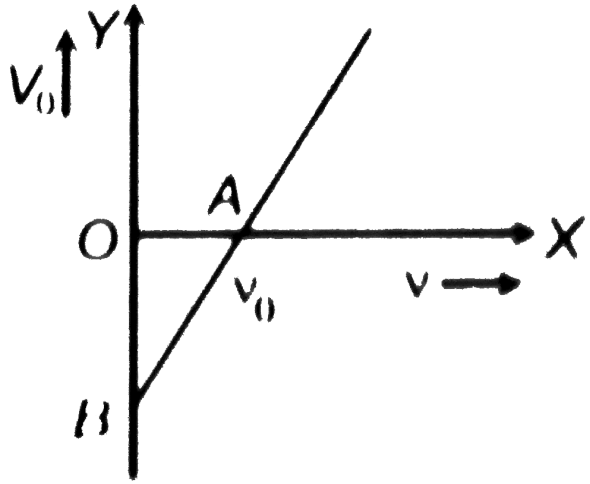
24. In an experiment on photoelectric effect the frequency f of the incident light is plotted against the stopping potential V_0. The work function of the metal is given by (e is the electronic charge)



A. $OB \times e$ in eV

B. OB in Volt

C. OA in Volt

D. The slope of the line AB

Answer: A

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25. The work function of a metal is $1.6 \times 10^{-19} J$. When the metal surface is illuminated by the light of wavelength 6400Å, then the maximum kinetic energy of emitted photo - electrons will be

(Planck's constant $h = 6.4 \times 10^{-34} Js$)

A. $14 \times 10^{-19} J$

B. $2.8 \times 10^{-19} J$

C. $1.4 \times 10^{-19} J$

D. $1.4 \times 10^{19} J$

Answer: C

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26. Ultraviolet radiation of 6.2 eV falls on an aluminium surface (work - function = 4.2 eV). The kinetic energy in joule of the fastest electrons emitted is

A. 3.2×10^{-21}

B. 3.2×10^{-19}

C. 3.2×10^{-17}

D. 3.2×10^{-15}

Answer: B

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27. The work function for tungsten and sodium are $4.5eV$ and $2.3eV$ respectively . If the threshold wavelength λ for sodium is $5460Å$, the value of λ for tungsten is

A. $5893Å$

B. $10683Å$

C. $2791Å$

D. $528Å$

Answer: C

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28. The work function of a metallic surface is $5.01eV$. The photo - electrons are emitted when light of wavelength 2000Å falls on it . The potential difference applied to stop the fastest photo - electrons is $\left[h = 4.14 \times 10^{-15} eV \sec\right]$

A. 1.2volts

B. 2.24volts

C. 3.6volts

D. 4.8volts

Answer: A

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29. Light of wavelength 4000Å falls on a photosensitive metal and a negative $2V$ potential stops the emitted electrons. The work function of the material (in eV) is approximately $\left(h = 6.6 \times 10^{-34} Js, e = 1.6 \times 10^{-19} C, c = 3 \times 10^{8} ms^{-1}\right)$

A. 1.1

B. 2.0

C. 2.2

D. 3.1

Answer: A

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30. When yellow light is incident on a surface , no electrons are emitted while green light can emit. If red light is incident on the surface , then

A. No electrons are emitted

B. Photons are emitted

C. Electrons of higher energy are emitted

D. Electrons of lower energy are emitted

Answer: A

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31. The photoelectric threshold of a certain metal is $3000A$. If the radiation of $2000A$ is incident on the metal

A. Electrons will be emitted

B. Positrons will be emitted

C. Neutrons will be emitted

D. Protons will be emitted

Answer: A

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32. A photocell stoops emission if it is maintained at $2V$ negative potential . The energy of most energetic photoelectron is

A. $2eV$

B. $2J$

C. $2kJ$

D. $2keV$

Answer: A

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33. Assuming photoemission to take place , the factor by which the maximum velocity of the emitted photoelectrons changes when the wavelength of the incident radiation is increased four times , is

A. 4

B. $\frac{1}{4}$

C. 2

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

Answer: D

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34. When a point source of light is at a distance of one metre from a photo cell , the cut off voltage is found to be V. If the same source is placed at $2m$ distance from photo cell , the cut off voltage will be

A. When a point source is at a distance of one metre from a photo cell , the cut off voltage is found to be V. If the same source is placed at $2m$ distance from photo cell , the cut off voltage will be

B. V

C. $V/2$

D. $V/4$

Answer: A

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35. If the work function of a metal is $'\phi'$ and the frequency of the incident light is $'v'$, there is no emission of photoelectron if

A. $v < \frac{\phi}{h}$

B. $v = \frac{\phi}{h}$

C. $v > \frac{\phi}{h}$

D. $v \geq \frac{\phi}{h}$

Answer: A

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36. Light of wavelength λ strikes a photo - sensitive surface and electrons are ejected with kinetic energy is to be increased to $2E$, the wavelength

must be changed to λ' where

A. $\lambda' = \frac{\lambda}{2}$

B. $\lambda' = 2\lambda$

C. $\frac{\lambda}{2} < \lambda' < \lambda$

D. $\lambda' > \lambda$

Answer: C

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37. Light of wavelength 5000Å falls on a sensitive plate with photoelectric work function of $1.9eV$. The kinetic energy of the photoelectron emitted will be

A. $0.58eV$

B. $2.48eV$

C. $1.24eV$

D. $1.16eV$

Answer: A

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38. If the work function of a photo - metal is $6.825eV$. Its threshold wavelength will be $\left(c = 3 \times 10^8 m/s\right)$

A. $1200Å$

B. $1800Å$

C. $2400Å$

D. $3600Å$

Answer: B

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39. Work function of a metal is $2.1eV$. Which of the waves of the following wavelengths will be able to emit photoelectrons from its surface ?

A. $4000Å, 7500Å$

B. $5500Å, 6000Å$

C. $4000Å, 6000Å$

D. None of these

Answer: D

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

A. Double the earlier value

B. Unchanged

C. More than doubled

D. Less than doubled

Answer: C

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41. When light of wavelength $300nm$ (nanometre) falls on a photoelectric emitter , however light of $600nm$ wavelength is sufficient for creating photoemission . What is the ratio of the work functions of the two emitters ?

A. $1:2$

B. $2:1$

C. $4:1$

D. $1:4$

Answer: B

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42. Threshold wavelength for photoelectric effect on sodium is 5000Å . Its work function is

A. $15J$

B. $16 \times 10^{-14} J$

C. $4 \times 10^{-19} J$

D. $4 \times 10^{-81} J$

Answer: C

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43. What is the stopping potential when the metal with work function $0.6eV$ is illuminated with the light of $2eV$?

A. $2.6V$

B. $3.6V$

C. $0.8V$

D. $1.4V$

Answer: D

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

A. Copper

B. Sodium

C. Both

D. None of these

Answer: B

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45. For intensity I of a light of wavelength 5000Å the photoelectron saturation current is $0.40\mu A$ and stopping potential is $1.36V$, the work function of metal is

A. $2.47eV$

B. $1.36eV$

C. $1.10eV$

D. $0.43eV$

Answer: C

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46. Light of frequency $8 \times 10^{15} Hz$ is incident on a substance of photoelectric work function $6.125eV$. The maximum kinetic energy of the emitted photoelectrons is

A. $17eV$

B. $22eV$

C. $27eV$

D. $37eV$

Answer: C

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47. The lowest frequency of light that will cause the emission of photoelectrons from the surface of a metal (for which work function is $1.65eV$) will be

A. $4 \times 10^{10} Hz$

B. $4 \times 10^{11} Hz$

C. $4 \times 10^{14} Hz$

D. $4 \times 10^{-10} Hz$

Answer: C

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

A. $1:5$

B. $1:4$

C. $1:2$

D. $1:1$

Answer: B

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49. Sodium and copper have work functions $2.3eV$ and $4.5eV$ respectively . Then the ratio of the wavelength is nearest

A. $1:2$

B. $4:1$

C. $2:1$

D. $1:4$

Answer: C

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50. When radiation is incident on a photoelectron emitter, the stopping potential is found to be 9 volts . If e/m for the electrons is $1.8 \times 10^{11} Ckg^{-1}$ the maximum velocity of the ejected electrons is

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

B. $8 \times 10^5 ms^{-1}$

C. $1.8 \times 10^6 ms^{-1}$

D. $1.8 \times 10^5 ms^{-1}$

Answer: C

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51. Light of frequency $4v_0$ is incident on the metal of the threshold frequency v_0. The maximum kinetic energy of the emitted photoelectrons is

A. $3hv_0$

B. $2hv_0$

C. $\frac{3}{2}hv_0$

D. $\frac{1}{2}hv_0$

Answer: A

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52. Energy required to remove an electron from aluminium surface is $4.2eV$. If light of wavelength 2000Å falls on the surface , the velocity of the fastest electron ejected from the surface will be

A. $8.4 \times 10^5 m/\sec$

B. $7.4 \times 10^5 m/\sec$

C. $6.4 \times 10^5 m/\sec$

D. $8.4 \times 10^6 m/\sec$

Answer: A

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53. A photon of energy $8eV$ is incident on a metal surface of threshold frequency $1.6 \times 10^{15} Hz$, then the maximum kinetic energy of photoelectrons emitted is $\left(h = 6.6 \times 10^{-34} Js\right)$

A. $4.8eV$

B. $2.4eV$

C. $1.4eV$

D. $0.8eV$

Answer: C

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54. Light of wavelength $1824Å$, incident on the surface of a metal , produces photo - electrons with maximum energy $5.3eV$. When light of wavelength $1216Å$ is used , maximum energy of photoelectrons is $8.7eV$. The work function of the metal surface is

A. $3.5eV$

B. $13.6eV$

C. $6.8eV$

D. $1.5eV$

Answer: D

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55. Mercury violet $(\lambda = 4558\text{Å})$ is falling on a photosensitive material $(\phi = 2.5eV)$. The speed of the ejected electrons is in ms^{-1}, about

A. 3×10^5

B. 2.65×10^5

C. 4×10^4

D. 3.65×10^7

Answer: B

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56. The work functions of metals A and B are in the ratio $1:2$. If light of frequencies f and $2f$ are incident on the surfaces of A and B respectively

, the ratio of the maximum kinetic energy of photoelectrons emitted is (f is greater than threshold frequency of A, $2f$ is greater than threshold frequency of B)

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: B

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57. When a metal surface is illuminated by light wavelengths $400nm$ and $250nm$, the maximum velocities of the photoelectrons ejected are v and $2v$ respectively . The work function of the metal is

$(h = \text{Planck's constant}, c = \text{velocity of light in air})$

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

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

C. $hc \times 10^6 J$

D. $0.5hc \times 10^6 J$

Answer: A

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

A. 2λ

B. 4λ

C. 6λ

D. 8λ

Answer: B

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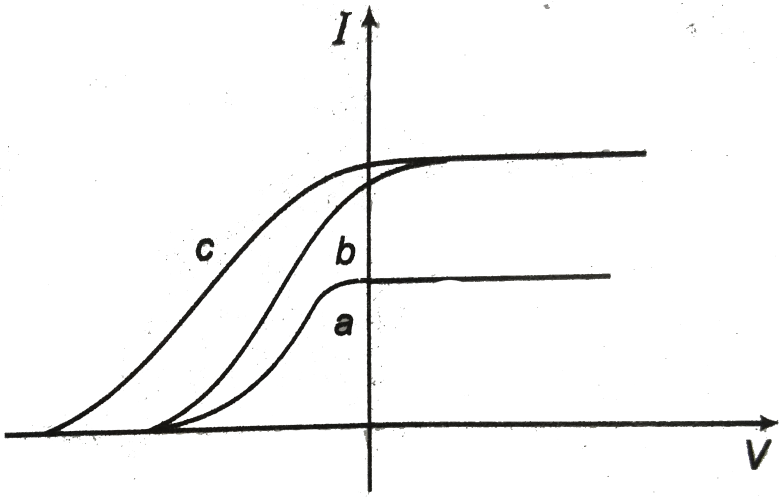
59. The figure shows the variation of photo current with anode potential for a photosensitive surface for three different radiations. Let I_a,$I_b$andI_c be the intensities and f_a,$f_b$andf_c be the frequencies for the curves a,b and c respectively



A. $f_a = f_b$ and $l_a \neq l_b$

B. $f_a = f_c$ and $l_a = l_c$

C. $f_a = f_c$ and $l_a \neq l_c$

D. $f_a = f_b$ and $l_a = l_b$

Answer: A

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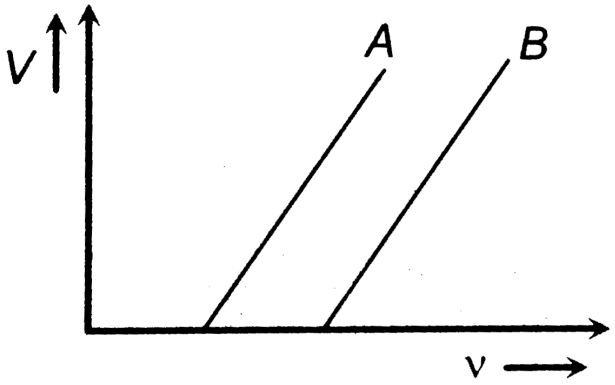
60. The stopping potential as a function of the frequency of the incident radiation is plotted for two different photoelectric surfaces A and B. The graphs show that work function of A is



A. Greater than that of B

B. Smaller than that of B

C. Equal to that of B

D. No inference can be drawn about their work functions from the given graphs

Answer: B

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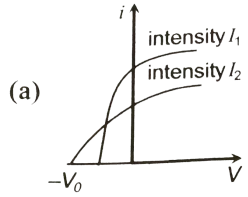
61. The curves $(a), (b), (c)$ and (d) show the variation between the applied potential difference (V) and the photoelectric current (i) , at two different intensities of light $(I_1 > I_2)$. In which figure is the correct variation shown ?

A.



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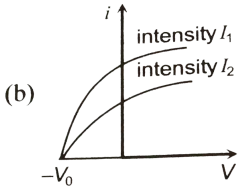

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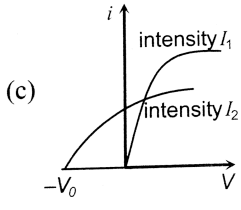
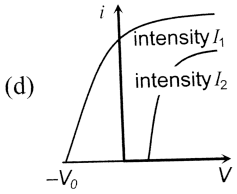


D.



Answer: B

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X Rays

1. By which way, the X-rays, and γ-rays can be distinguised?

A. Their velocity

B. Their ionising power

C. Their intensity

D. Method of production

Answer: D

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2. Molybdenum is used as a target element for production of X - rays because it is

A. A heavy element and can easily absorb high velocity electrons

B. A heavy element with a high melting point

C. An element having high thermal conductivity

D. Heavy and can easily deflect electrons

Answer: B

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3. The continuous X - rays spectrum produced by an X - ray machine at constant voltage has

A. A maximum wavelength

B. A minimum wavelength

C. A single wavelength

D. A minimum frequency

Answer: B

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4. Which of the following is accompanied by the characteristic X - ray emission ?

A. α - particle emission

B. Electron emission

C. Positron emission

D. K - electron capture

Answer: D

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5. In an X - rays tube , the intensity of the emitted X - rays beam is increased by

A. Increasing the filament current

B. Decreasing the filament current

C. Increasing the target potential

D. Decreasing the target potential

Answer: A

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6. Penetrating power of X - rays depends on

A. Current flowing in the filament

B. Applied potential difference

C. Nature of the target

D. All of the above

Answer: B

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7. The energy of a photon of characteristic X-ray from a Coolidge tube comes from

A. The kinetic energy of the striking electron

B. The kinetic energy of the free electrons of the target

C. The kinetic energy of the ions of the target

D. An electronic transition of the target atom

Answer: D

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8. Penetrating power of X - rays can be increased by

A. Increasing the potential difference between anode and cathode

B. Decreasing the potential difference between anode and cathode

C. Increasing the cathode filament current

D. Decreasing the cathode filament current

Answer: A

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9. The essential distinction between X - rays and γ - rays is that

A. γ - rays have smaller wavelength than X - rays

B. γ - rays emanate from nucleus while X - rays emanate from outer part of the atom

C. γ - rays have greater ionizing power than X - rays

D. γ - rays are more penetrating than X - rays

Answer: B

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10. What determines the hardness of the X - rays obtained from the Coolidge filament ?

A. Current in the filament

B. Pressure of air in the tube

C. Nature of target

D. Potential difference between cathode and target

Answer: D

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11. The most penetrating radiation out of the following is

A. X - rays

B. β - rays

C. α - particles

D. γ- rays

Answer: D

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12. On increasing the number of electrons striking the anode of an X - ray tube , which one of the following parameters of the resulting X - rays would increase ?

A. Penetration power

B. Frequency of the incident light

C. Wavelength

D. Intensity

Answer: D

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13. Penetrating power of X - rays does not depend on

A. Wavelength

B. Energy

C. Potential difference

D. Current in the filament

Answer: D

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14. The wavelength of X - rays decreases , when

A. Temperature of target is increased

B. Intensity of electron beam is increased

C. $K.\ E.$ Of electrons striking the target is increased

D. $K.\ E.$ Of electrons striking the target is decreased

Answer: C

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15. If the cathode - anode potential difference in an X - ray tube be $10^5 V$, then the maximum energy of X - ray photon can be

A. $10^5 J$

B. $10^5 MeV$

C. $10^{-1} MeV$

D. $10^5 KeV$

Answer: C

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16. The shorted wavelength of X- rays emitted from an X- rays tube depends on

A. Current in the tube

B. Voltage applied to the tube

C. Nature of gas in the tube

D. Atomic number of target material

Answer: B

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17. When a beam of accelerated electrons hits a target , a continuous X - ray spectrum is emitted from the target. Which of the following

wavelength is absent in X - ray spectrum , if the X - ray tube is operating at $40,000 \text{volts}$?

A. 0.25Å

B. 0.5Å

C. 1.5Å

D. 1.0Å

Answer: A

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18. If λ_1 and λ_2 are the wavelength of characteristic X - rays and gamma rays respectively , then the relation between them is

A. $\lambda_1 = \frac{1}{\lambda_2}$

B. $\lambda_1 = \lambda_2$

C. $\lambda_1 > \lambda_2$

D. $\lambda_1 < \lambda_2$

Answer: C

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19. The wavelength λ of the K_a line of characteristic X - ray spectra varies with atomic number approximately

A. $\lambda \propto Z$

B. $\lambda_1 \propto \sqrt{Z}$

C. $\lambda \propto \frac{1}{Z^2}$

D. $\lambda \propto \frac{1}{\sqrt{Z}}$

Answer: C

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20. The minimum wavelength of X - rays produced by electrons accelerated by a potential difference of volts is equal to

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

B. $\frac{eh}{cV}$

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

D. $\frac{cV}{eh}$

Answer: C

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21. The potential difference applied to an X-ray tube is increased. As a result, in the emitted radiation,

A. The intensity increases

B. The minimum wavelength increases

C. The intensity decreases

D. The minimum wavelength decreases

Answer: D

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22. A potential difference of $42,000 \text{volts}$ is used in an X - ray tube to accelerate electrons . The maximum frequency of the X - radiations produced is

A. $10^{19} Hz$

B. $10^{18} Hz$

C. $10^{16} Hz$

D. $10^{20} Hz$

Answer: A

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23. The binding energy of the innermost electron in tungsten is $40keV$. To produce characteristic X - rays using a tungsten target in an X - rays tube the potential difference V between the cathode and the anti - cathode should be

A. $V < 40kV$

B. $V \leq 40kV$

C. $V > 40kV$

D. $V > / < 40kv$

Answer: C

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24. Mosley measured the frequency (f) of the characteristic X - rays from many metals of different atomic number (Z) and represented his results by a relation known as Mosley's law. This law is (a, b are constants)

A. $f = a(Z - b)^2$

B. $Z = a(f - b)^2$

C. $f^2 = a(Z - b)$

D. $f = a(Z - b)^{1/2}$

Answer: A

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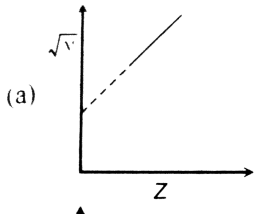
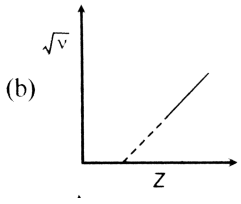
25. The graph between the square root of the frequency of a specific line of characteristic spectrum of X - rays and the atomic number of the target will be

A.



B.



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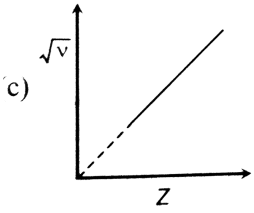

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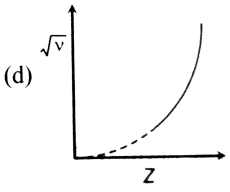

Answer: B

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26. The minimum wavelength of the X - rays produced by electrons accelerated through a potential difference of $V\text{volts}$ is directly proportional to

A. $\sqrt{V}$

B. V^2

C. $1/\sqrt{V}$

D. $1/V$

Answer: D

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27. Energy of K - shell electron be $-40000eV$. If $60000V$ potential is applied at Coolidge tube then which of the following X - rays will get form ?

A. Continuous

B. White X - rays

C. Continuous and all series of characteristic

D. None of these

Answer: C

Watch Video Solution

28. For production of characteristic $K_\beta X - rays$, the electron transition is

A. $n = 2 \to n = 1$

B. $n = 3 \to n = 2$

C. $n = 3 \to n = 1$

D. $n = 4 \to n = 2$

Answer: C

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29. X-rays are produced by accelerating electrons by voltage V and let they strike a metal of atomic number Z . The highest frequency of $X - rays$ produced is proportional to

A. V

B. Z

C. $(Z-1)$

D. $(Z-1)^2$

Answer: D

Watch Video Solution

30. If the minimum wavelength obtained in an X - ray tube is $2.5 \times 10^{-10} m$, the operating potential of the tube will be

A. $2kV$

B. $3kV$

C. $4kV$

D. $5kV$

Answer: D

Watch Video Solution

31. An X - ray tube with a copper target emits CuK_α line of wavelength 1.50Å. What should be the minimum voltage through which electrons are to be accelarated to produce this wavelength of X - rays ?

$\left(h = 6.63 \times 10^{-34} J - \sec, c = 3 \times 10^8 m/s\right)$

Watch Video Solution

32. The wavelength of K_α line in copper is 1.54Å. The ionisation energy of K electron in copper in Joule is

A. 11.2×10^{-27}

B. 12.9×10^{-16}

C. 1.7×10^{-15}

D. 10×10^{-16}

Answer: B

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33. The wavelength of K_α line for an element of atomic number $43 is \lambda$. Then the wavelength of K_α line for an element of atomic number 29 is

A. $\frac{43}{29}\lambda$

B. $\frac{42}{28}\lambda$

C. $\frac{9}{4}\lambda$

D. $\frac{4}{9}\lambda$

Answer: C

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34. In X-ray tube , when the accelerating voltage V is halved, the difference between the wavelength of K_α line and minimum wavelength of continuous X-ray spectrum

A. Remains constant

B. Becomes more than two times

C. Becomes half

D. Becomes less than two times

Answer: D

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35. Let $\lambda_{\alpha}{}', \lambda_{\beta}, \text{ and } \lambda'_{\alpha}$ denote the wavelength of the X-ray of the $K_{\alpha}, K_{\beta}, \text{ and } L_{\alpha}$ lines in the characteristic X-rays for a metal. Then.

A. $\lambda_a > \lambda'_a$ and λ_{β}

B. $\lambda'_{\alpha} > \lambda_{\beta} > \lambda_{\alpha}$

C. $\frac{1}{\lambda_{\beta}} = \frac{1}{\lambda_{\alpha}} + \frac{1}{\lambda'_a}$

D. $\frac{1}{\lambda_{\alpha}} + \frac{1}{\lambda_{\beta}} = \frac{1}{\lambda'_{\alpha}}$

Answer: C

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36. The K_α X-ray emission line of lungsten accurs at $\lambda = 0.021nm$. What is the energy difference between $K$and L levels in the atom?

A. $0.51MeV$

B. $1.2MeV$

C. $59KeV$

D. $13.6eV$

Answer: C

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37. Electrons with energy $80keV$ are incident on the tungsten target of an X - rays tube , k- shell electrons of tungsten have $72.5keV$ energy X-rays emitted by the tube contain only

A. A continuous X - ray spectrum ("Bremsstrahlung") with a minimum wavelength of ~ 0.155 Å`

B. A continuous X` - "ray spectrum (Bremsstrahlung)" with all wavelengths

C. The characteristic X - rays spectrum of tungsten

D. A continuous X - ray spectrum "(Bremsstrahlung) with a minimum wavelength of" ~0.155Å and "the characteristic" X - ray spectrum of tungsten

Answer: D

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38. The X- ray wavelength of L_α line of platinum $(Z = 78)$ is 1.30Å. The X - ray wavelength of L_α line of Molybdenum $(Z = 42)$ is

A. 5.41Å

B. 4.20Å

C. 2.70Å

D. $1.35Å$

Answer: A

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39. An X-ray tube is operated at $50kV$ and $20mA$. The target material of the tube has mass of $1kg$ and specific heat $495Jkg^{-1}$^(@)C^(-1)`. One perent of applied electric power is converted into X-rays and the remaining energy goes into heating the target. Then,

A. A suitable target material must have a low melting temperature

B. A suitable target material must have low thermal conductivity

C. The average rate of rise of temperature of target would be $4^{\circ}C/s$

D. The minimum wavelength of the X - rays emitted is about $0.25 \times 10^{-10}m$

Answer: D

Watch Video Solution

40. The wavelength of k_α X- rays produced by an X - rays tube is 0.76Å . The atomic number of the anode material of the tube is .....

A. 20

B. 60

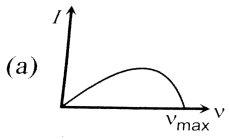
C. 40

D. 80

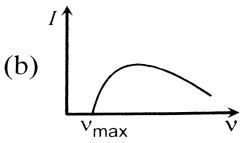
Answer: C

Watch Video Solution

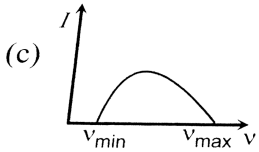
41. The continuous x - ray spectrum obtained from a Coolidge tube is of the form

A. 

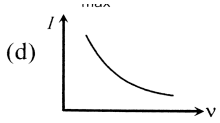
B.



C.



D.



Answer: A

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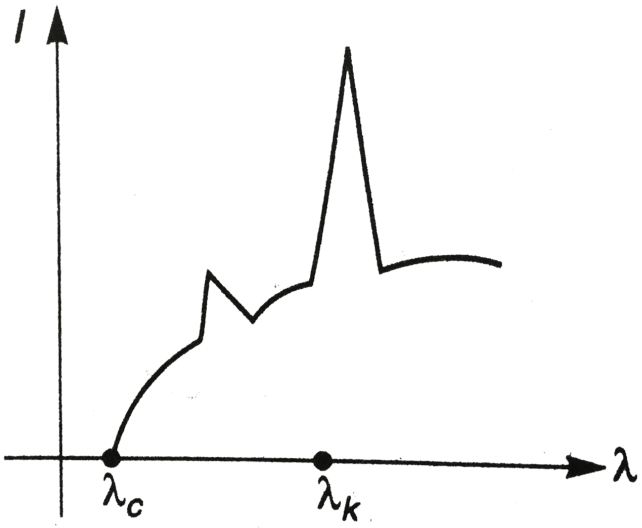
42. The intensity of X-rays form a Coolidge tube is plotted against wavelength λ as shown in the figure. The minimum wavelength found is λ_c and the wavelength of the K_α line is λ_k. As the accelerating voltage is



increased

(a) $\lambda_k - \lambda_c$ increases (b) $\lambda_k - \lambda_c$ decreases

(c) λ_k increases (d) λ_k decreases

A. $(\lambda_K - \lambda_C)$ increases

B. $(\lambda_K - \lambda_C)$ decreases

C. λ_K increases

D. λ_K decreases

Answer: A

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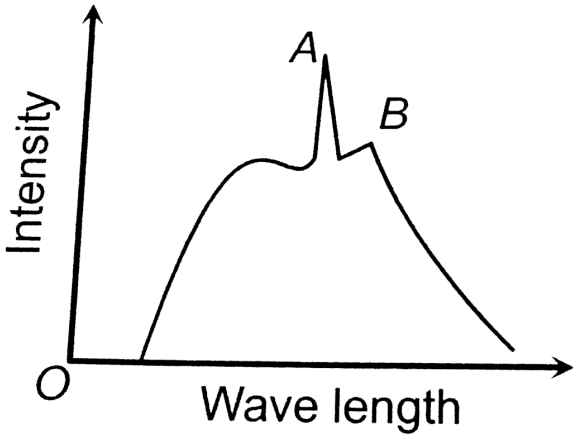
43. The figure represents the observed intensity of X - rays emitted by an X - ray tube as a function of wavelength . The sharp peaks A and B denote



A. Band spectrum

B. Continuous spectrum

C. Characteristic radiations

D. White radiations

Answer: C

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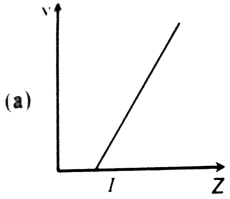
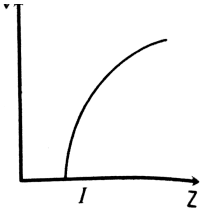
44. The graph that correctly represents the relation of frequency v of a particular characteristic X - ray with the atomic number Z of the material is

A.

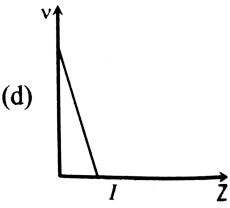


B.



C.

D.



Answer: C

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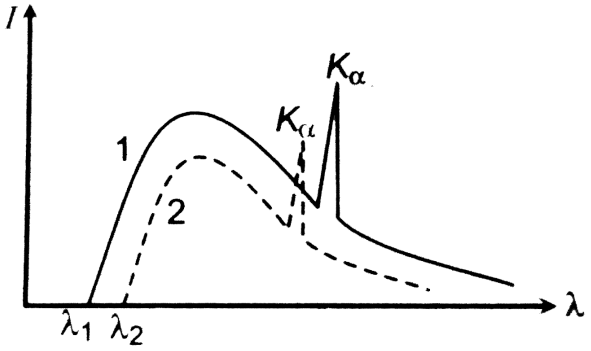
45. The intensity distribution of X - rays from two Coolidge tubes operated on different voltages V_1 and V_2 and using is shown in the figure . Which one of the following inequalities is true ?



A. $V_1 > V_2, Z_1 < Z_2$

B. $V_1 > V_2, Z_1 > Z_2$

C. $V_1 < V_2, Z_1 > Z_2$

D. $V_1 = V_2, Z_1 < Z_2$

Answer: A

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Problems Based On Mixed Concepts

1. A beam of light of wavelength λ is totally reflected at normal incidence by a plane mirror . The intensity of the light is such that photons hit the mirror . The intensity of the light is such that photons hit the mirror at a rote n . Given that the Planck constant is h , the force exerted on the mirror by this beam is

A. $nh\lambda$

B. nh/λ

C. $2nh/\lambda$

D. $2n\lambda/h$

Answer: D

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2. The short-wavelength limit shifts by 26 pm when the operating voltage in an X-ray tube is increased to 1.5 times the original value. What was the original value of the operating voltage?

A. $\approx 10kV$

B. $\approx 16kV$

C. $\approx 50kV$

D. $\approx 75kV$

Answer: B

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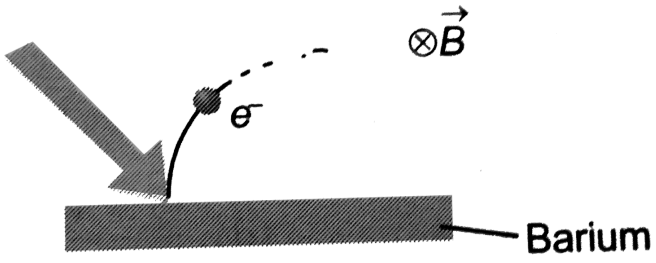
3. Light of wavelength 2475Å is incident on barium. Photoelectrons emitted describe a circle of radius $100cm$ by a magnetic field of flux density $\frac{1}{\sqrt{17}} \times 10^{-5} Tesla.$

Work function of the barium is (Given $\frac{e}{m} = 1.7 \times 10^{11}$)



A. $1.8eV$

B. $2.1eV$

C. $4.5eV$

D. $3.3eV$

Answer: C

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4. Five elements A, B, C, D and E have work functions $1.2eV, 2.4eV, 3.6eV, 4.8eV$ and $6eV$ respectively . If light of wavelength 4000Å is allowed to fall on these elements , then photoelectrons are emitted by

A. A, B and C

B. A, B, C, D and E

C. A and B

D. Only E

Answer: C

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5. If light of wavelength λ_1 is allowed to fall on a metal , then kinetic energy of photoelectrons emitted is E_1. If wavelength of light changes to λ_2 then kinetic energy of electrons changes to E_2. Then work function of the metal is

A. $\frac{E_1E_2(\lambda_1 - \lambda_2)}{\lambda_1\lambda_2}$

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

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

D. $\frac{\lambda_1\lambda_2E_1E_2}{(\lambda_2 - \lambda_1)}$

Answer: C

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6. If maximum velocity with which an electron can be emitted from a photo cell is $4 \times 10^8 cm/\sec$, the stopping potential is (mass of electron $= 9 \times -31 kg$)

A. 30volt

B. 45volt

C. 59volt

D. Information is insufficient

Answer: B

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7. Three particles having their changes in the ratio of $1:3:5$ produce the same spot on the screen in Thomson's experiment . Their respective masses are in the ratio of

A. $5:3:1$

B. $3:1:5$

C. $1:3:5$

D. $5:1:3$

Answer: C

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8. If the momentum of an electron is changed by Δp , then the de - Broglie wavelength associated with it changes by $0.50\,\%$. The initial momentum of the electron will be

A. $\frac{\Delta p}{200}$

B. $\frac{\Delta p}{199}$

C. $199\Delta p$

D. $400\Delta p$

Answer: C

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9. A potential of 10000 V is applied across an x-ray tube. Find the ratio of de-Broglie wavelength associated with incident electrons to the minimum wavelength associated with x-rays.

A. 1

B. 0.1

C. 0.2

D. 0.3

Answer: B

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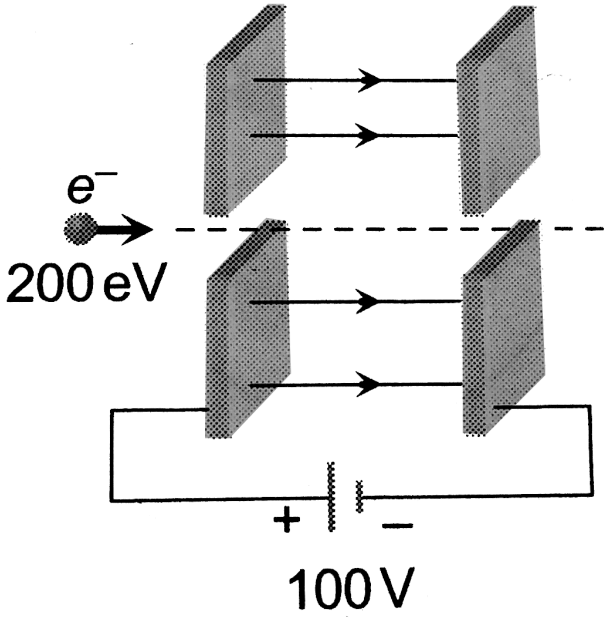
10. Two large parallel plates are connected with the terminal of $100V$ power supply. These plates have a fine hole at the centre . An electron having energy $200eV$ is so directed that it passes through the holes . When it comes out its de - Broglie wavelength is



A. $1.22Å$

B. $1.75Å$

C. $2Å$

D. None of these

Answer: A

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11. According to Bohr's theory , the electron in orbits have definite energy values , then according to uncertainty principle , the life of an excited state will be

A. Zero

B. Finite

C. $10^{-8}\,\text{sec}$

D. Infinite

Answer: D

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12. Monochromatic light of wavelength 3000Å is incident on a surface area $4cm^2$. If intensity of light is $150mW/m^2$, then rate at which photons strike the target is

A. $3 \times 10^{10}/\text{sec}$

B. $9 \times 10^{13}/\text{sec}$

C. $7 \times 10^{15}/\text{sec}$

D. $6 \times 10^{19}/\text{sec}$

Answer: B

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13. For characteristic X - ray of some material

A. $E(K_\gamma) < E(K_\beta) < E(K_\alpha)$

B. $E(K_\alpha) < E(L_\alpha) < E(M_\alpha)$

C. $\lambda(K_\gamma) < \lambda(K_\beta) < \lambda(K_\alpha)$

D. $\lambda(M_\alpha) < \lambda(L_\alpha) < \lambda(K_\alpha)$

Answer: C

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14. 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. $> 2V$

C. $< 2V$

D. Between $2V$ and $4V$

Answer: B

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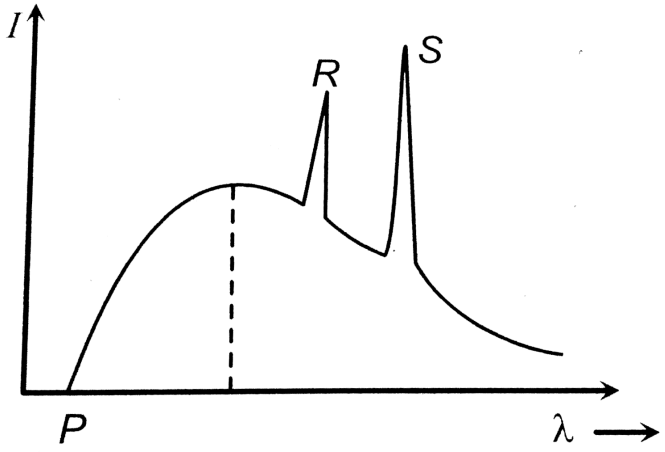
15. If the potential difference between the anode and cathode of the X - ray tube is increases



A. The peaks at R and S would move to shorter wavelength

B. The peaks at R and S would remain at the same wavelength

C. The cut off wavelength at P would decrease

D. (b) and (c) both are correct

Answer: D

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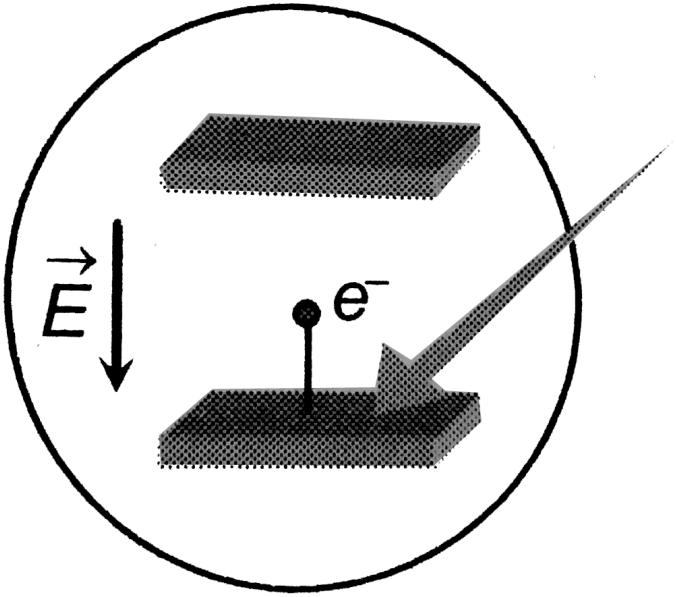
16. The collector plate in an experiment on photoelectric effect is kept vertically above the emitter plate . Light source is put on and a saturation photo current is recorded . An electric field is switched on which has a vertically downward direction . Then



A. The photo current will increase

B. The kinetic energy of the electrons will increase

C. The stopping potential will decrease

D. The threshold wavelength will increase

Answer: B

Watch Video Solution

17. A $1\mu A$ beam of protons with a cross - sectional area of $0.5sq.\ mm$ is moving with a velocity of $3 \times 10^4 ms^{-1}$. Then charge density of beam is

A. $6.6 \times 10^{-4} C/m^3$

B. $6.6 \times 10^{-5} C/m^3$

C. $6.6 \times 10^{-6} C/m^3$

D. None of these

Answer: B

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18. A particle of mass M at rest decay's into two particle of masses m_1 and m_2 having non zero velocity. The ratio of the de Broglie wavelengths

of the masses λ_1 / λ_2 is

A. m_1 / m_2

B. m_2 / m_1

C. 1.0

D. $\sqrt{m_2} / \sqrt{m_1}$

Answer: C

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19. A photon and an electron have equal energy E. $\lambda_{\text{photon}} / \lambda_{\text{electron}}$ is proportional to

A. $\sqrt{E}$

B. $1 / \sqrt{E}$

C. $1 / E$

D. Does not depend upon E

Answer: B

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20. Radiation of wavelength λ in indent on a photocell . The fastest emitted electron has speed v if the wavelength is changed to $\frac{3\lambda}{4}$, then speed of the fastest emitted electron will be

A. $v(3/4)^{1/2}$

B. $v(4/3)^{1/2}$

C. Less than $v(4/3)^{1/2}$

D. Greater than $v(4/3)^{1/2}$

Answer: D

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21. Ultraviolet light of wavelength 300nn and intensity $1.0Wm^{-2}$ falls on the surface of a photosensitive material. If one per cent of the incident photons produce photoelectrons, then the number of photoelectrons emitted per second from an area of 1.0 cm^2 of the surface is nearly

A. $9.61 \times 10^{14} per \sec$

B. $4.12 \times 10^{13} per \sec$

C. $1.51 \times 10^{12} per \sec$

D. $2.13 \times 10^{11} per \sec$

Answer: C

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22. Photoelectric emission is observed from a metallic surface for frequencies v_1 and v_2 of the incident light rays $(v_1 > v_2)$. If the maximum values of kinetic energy of the photoelectrons emitted in the two cases

are in the ratio of $1:k$, then the threshold frequency of the metallic surface is

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

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

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

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

Answer: B

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23. 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. $-4.2V$

B. $-9.4V$

C. $-17.8V$

D. $+9.4V$

Answer: B

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24. 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. Lithium

B. Copper

C. Both

D. None of these

Answer: A

Watch Video Solution

25. The largest distance between the interatomic planes of crystal is $10^{-7}cm$. The upper limit for the wavelength of X - rays which can be usefully studied with this crystal is

A. $1Å$

B. $2Å$

C. $10Å$

D. $20Å$

Answer: D

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26. Find the ratio of de Broglie wavelength of molecules of hydrogen and helium which are at temperatures 27° and $127^\circ C$, respectively.

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

B. $\sqrt{\frac{3}{8}}$

C. $\sqrt{\frac{8}{3}}$

D. 1

Answer: C

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27. A silver of radius $4.8cm$ is suspended by a thread in the vacuum chamber . UV light of wavelength $200nm$ is incident on the ball for some times during which a total energy of $1 \times 10^{-7}J$ falls on the surface . Assuming on an average one out of 103 photons incident is able to eject electron. The potential on sphere will be

A. $1V$

B. $2V$

C. $3V$

D. Zero

Answer: C

Watch Video Solution

28. A photon of wavelength 6630Å is incident on a totally reflecting surface . The momentum delivered by the photon is equal to

A. $6.63 \times 10^{-27} kg - m/\sec$

B. $2 \times 10^{-27} kg - m/\sec$

C. $10^{-27} kg - m/\sec$

D. None of these

Answer: B

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29. The ratio of de - Broglie wavelength of α- particle to that of a proton being subjected to the same magnetic field so that the radii of their path

are equal to each other assuming the field induction vector $\overrightarrow{B}$ is perpendicular to the velocity vectors of the α - particle and the proton is

A. 1

B. $\frac{1}{4}$

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

D. 2

Answer: C

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30. K_α wavelength emitted by an atom of atomic number Z=11 is λ. Find the atomic number for an atom that emits K_α radiation with wavelength 4λ.

(a) Z=6 (b) Z=4

(c) Z=11 (d) Z=44.

A. $Z = 6$

B. $Z = 4$

C. $Z = 11$

D. $Z = 44$

Answer: A

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31. The potential energy of a partical varies as .

$U(x) = E_0$ for $0 \leq x \leq 1$

$= 0$ for $x > 1$

for $0 \leq x \leq 1$ de- Broglie wavelength is λ_1 and for $x > 1$ the de-Broglie wavelength is λ_2. Total energy of the partical is $2E_0$. find $\frac{\lambda_1}{\lambda_2}$.

A. 2

B. 1

C. $\sqrt{2}$

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

Answer: C

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32. In order to coincide the parabolas formed by singly ionized ions in one spectrograph and doubly ionized ions in the other Thomson's mass spectrograph , the electric fields and magnetic fields are kept in the ratios $1:2$ and $3:2$ respectively . Then the ratio of masses of the ions is

A. $3:4$

B. $1:3$

C. $9:4$

D. None of thses

Answer: C

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33. In a photocell bichromatic light of wavelength 2475Å and 6000Å are incident on cathode whose work function is $4.8eV$. If a uniform magnetic field of $3 \times 10^{-5} tesla$ exists parallel to the plate, the radius of the path described by the photoelectron will be (mass of electron $= 9 \times 10^{-31} kg$)

A. $1cm$

B. $5cm$

C. $10cm$

D. $25cm$

Answer: B

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

energy $5eV$ 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 $2eV$ Determine

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

(b) the magnitude of the electron field between the plate A and B at $i = 10s, \text{ and}$

(c) the kinetic energy of the most energotic photoelectrons emitted at $i = 10s$ whenit reaches plate B

Negilect the time taken by the photoelectrons to reach plate B Take $\varepsilon_0 = 8.85 \times 10^{-12} C^2 N - m^2$

A. $2 \times 10^3 N/C$

B. $10^3 N/C$

C. $5 \times 10^3 N/C$

D. Zero

Answer: A

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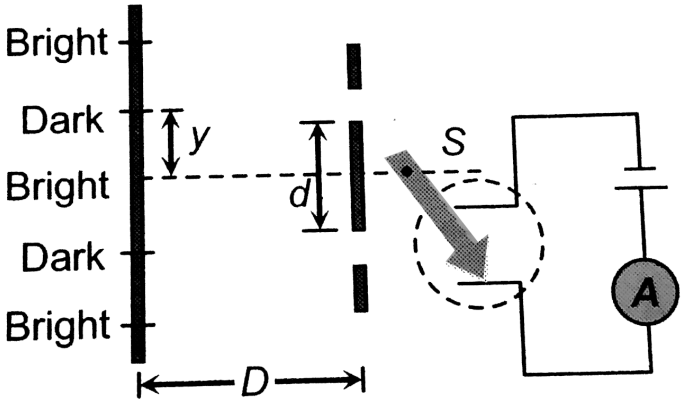
35. In the following arrangement $y = 1.0mm, d = 0.24mm$ and $D = 1.2m$. The work function of the material of the emitter is $2.2eV$. The stopping potential V needed to stop the photo current will be



A. $0.9V$

B. $0.5V$

C. $0.4V$

D. $0.1V$

Answer: A

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36. The eye can detect 5×10^4 photons $\left(m^2 s\right)^{-1}$ of green light ($\lambda = 5000A$), whole ear can detect $10^{-13} W m^2$. As a power detector, which is more sensitive and by what factor?

A. 5

B. 10

C. 10^6

D. 15

Answer: A

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37. A photon collides with a stationary hydrogen atom in ground state inelastically. Energy of the colliding photon is 10.2 eV. After a time interval of the order of micro second another photon collides with same hydrogen atom inelastically with an energy of 15eV. What wil be observed by the detector?

(a) 2 photons of energy 10.2 eV

(b) 2 photons of energy 1.4 eV

(c) One photon of energy 10.2 eV and an electron of energy 1.4 eV

(d) One photon of energy 10.2 eV and another photon of energy 1.4 eV

A. 2 photon of energy $10.2eV$

B. 2 photon of energy $1.4eV$

C. One photon of energy $10.2eV$ and an electron of energy $1.4eV$

D. One photon of energy $10.2eV$ and another photon of $1.4eV$

Answer: C

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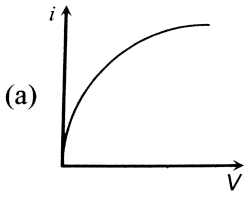
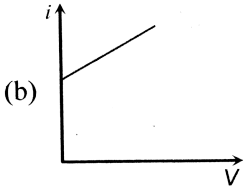
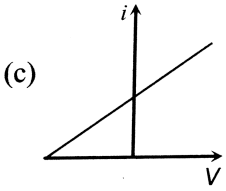
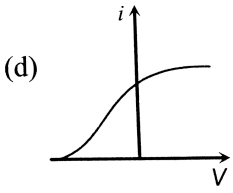
38. The curve between current (i) and potential difference (V) for a photo cell will be

A. 

B. 

C. 

D. 

Answer: D

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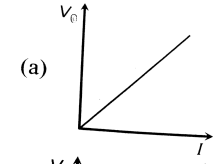
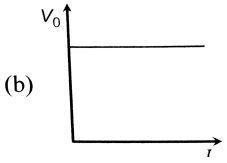
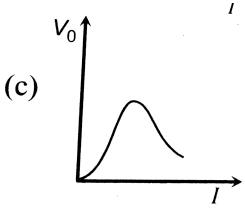
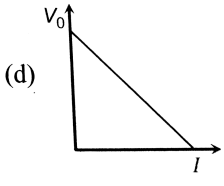
39. The correct curve between the stopping potential (V) and intensity of incident light (I) is

A. 

B. 

C. 

D. 

Answer: B

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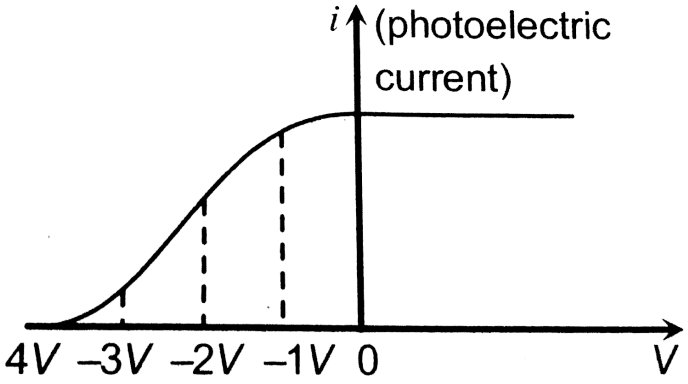
40. The value of stopping potential in the following diagram



A. $-4V$

B. $-3V$

C. $-2V$

D. $-1V$

Answer: A

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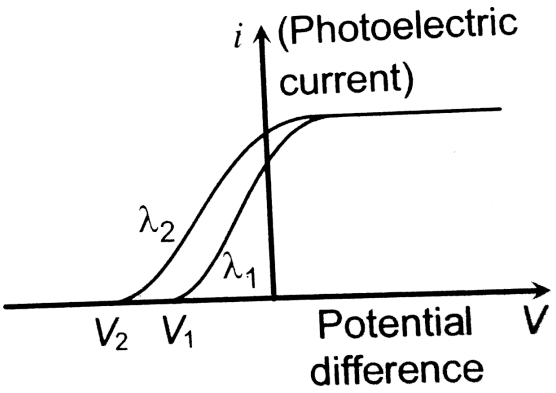
41. In the following diagram if $V_2 > V_1$ then



A. $\lambda_1 = \sqrt{\lambda_2}$

B. $\lambda_1 < \lambda_2$

C. $\lambda_1 = \lambda_2$

D. $\lambda_1 > \lambda_2$

Answer: D

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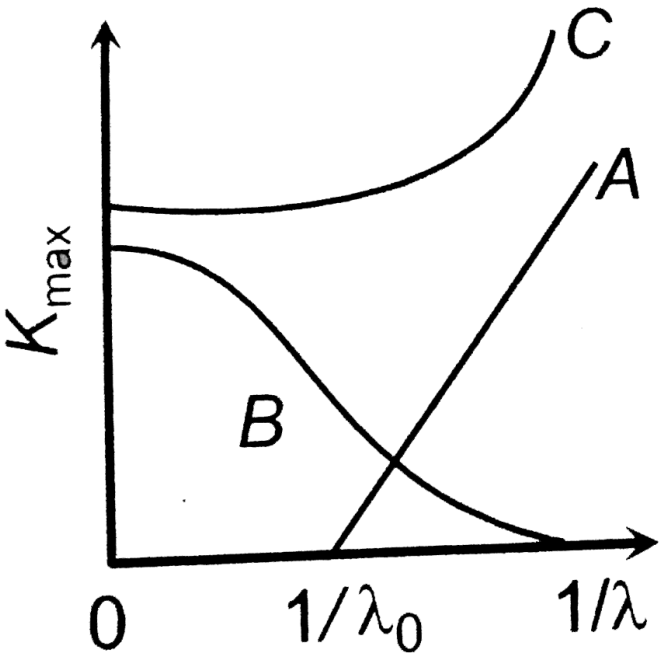
42. The correct graph between the maximum energy of a photoelectron and the inverse of wavelength of the incident radiation is given by the

curve



A. A

B. B

C. C

D. None of the above

Answer: A

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Section B Assertion Reasoning

1. Assertion : Kinetic energy of photo electrons emitted by a photosensitive surface depends upon the intensity of incident photon.

Reason : The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: D

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2. Assertion : The specific charge of positive rays is not constant.

Reason : The mass of ions varies with speed.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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3. Assertion : Photosensitivity of a metal is high if its work function is small.

Reason : Work function $= hf_0 where f_0$ is the threshold frequency.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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4. Assertion : The de - Broglie wavelength of a molecule varies inversely as the square root of temperature.

Reason : The root mean square velocity of the molecule depends on the temperature.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: A

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5. Assertion : Light is produced in gases in the process of electric discharge through them at high pressure.

Reason : At high pressure electrons of gaseous atoms collide and reach and excited state.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: D

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6. Assertion : If different gases are filled turn by turn at the same pressure in the discharge tube the discharge in them takes place at the same potential.

Reason : The discharge depends only on the pressure of discharge tube and not on the ionisation potential of gas.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: D

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7. Assertion : An electric field is preferred in comparison to magnetic field for detecting the electron beam in a television picture tube.

Reason : Electric field require low voltage.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: D

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8. Assertion : The specific charge for positive rays is a characteristic constant.

Reason : The specific charge depends on charge and mass of positive ions present in positive rays .

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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9. Assertion : In photoelctric effect , on increasing the intensity of light , both the number of electrons emitted and kinetic energy of each of them get increased but photoelectric current remains unchanged.

Reason : The photoelectric current depends only on wavelength of light .

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: D

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10. Assertion : Though light of a single frequency (monochromatic) is incident on a metal , the energies of emitted photoelectrons are different.

Reason : The energy of electrons emitted from inside the metal surface is lost in collision with the other atoms in the metal.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: A

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11. Assertion : The threshold frequency of photoelectric effect supports the particle nature of sunlight .

Reason : If frequency of incident light is less than the threshold frequency , electrons are not emitted from metal surface.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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12. Assertion : In photoemissive cell inert gas is used.

Reason : Inert gas in the photoemissive cell gives greater current.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: A

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13. Assertion : X - rays cannot be diffracted by means of grating .

Reason : X - rays does not obey Bragg's law.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: C

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14. Assertion : X - rays can penetrate through the flesh but not through the bones.

Reason : The penetrating power of X - rays depends on voltage.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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15. Assertion : Intensity of X - rays can be controlled by adjusting the filament current and voltage.

Reason : The intensity of X - ray photons emitted per second from the target.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: C

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16. Assertion : Anode of Coolidge tube gets heated up at time of emission of X - rays .

Reason : The anode of Coolidge tube is made of a material of high melting point.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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17. Assertiion : X - rays are used for studying the structure of crystals.

Reason : The distance between the atoms of crystals is of the order of wavelength of X - rays.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: A

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18. Assertion : The phenomenon of X - ray production is basically inverse of photoelectric effect.

Reason : X - rays are electromagnetic waves.

A. If both assertion and reason are true and reason is the correct explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion and reason both are false.

Answer: B

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Aipmt Neet Questions

1. The photoelectric threshold wavelength for potassium (work function being $2eV$) is

A. $310nm$

B. $620nm$

C. $1200nm$

D. $2100nm$

Answer: B

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2. A photocell is illuminated by a small bright source places 1 m away when the same source of light is placed $\frac{1}{2}$ m away. The number of electron emitted by photocathode would be

A. Decrease by a factor of 2

B. Increase by a factor of 2

C. Decrease by a factor of 4

D. Increase by a factor of 4

Answer: D

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3. Let K_1 be the maximum kinetic energy of photoelectrons emitted by a light of wavelength λ_1 and K_2 corresponding to λ 2). If $\lambda_1 = 2\lambda_2$, then

A. $2K_A = K_B$

B. $K_A < K_B/2$

C. $K_A = 2K_B$

D. $K_A = K_B/2$

Answer: B

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4. Which of the following is not the property of a cathode rays

A. It casts shadow

B. It produces heating effect

C. It produces fluorescence

D. It does not deflect in electric field

Answer: D

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5. If particles are moving with same velocity , then maximum de - Broglie wavelength will be for

A. Neutron

B. Proton

C. β - particle

D. α - particle

Answer: C

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6. A $1\mu A$ beam of protons with a cross - sectional area of $0.5sq.\ mm$ is moving with a velocity of $3 \times 10^4 ms^{-1}$. Then charge density of beam is

A. $6.6 \times 10^{-4} C/m^3$

B. $6.6 \times 10^{-5} C/m^3$

C. $6.6 \times 10^{-6} C/m^3$

D. None of these

Answer: B

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7. The work function of a metal is $4.2eV$, its threshold wavelength will be

A. 4000Å

B. 3500Å

C. 2955Å

D. 2500Å

Answer: C

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8. A photoelectric cell is illuminated by a point source of light $1m$ away . When the source is shifted to $2m$ then

A. Number of electrons emitted is half the initial number

B. Each emitted electron carries half the initial energy

C. Number of electrons emitted is a quarter of the initial number

D. Each emitted electron carries one quarter of the initial energy

Answer: C

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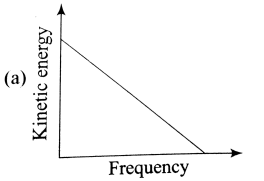
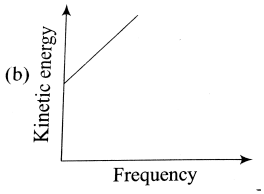
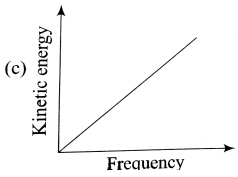
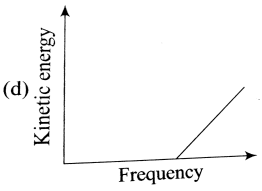
9. According to Einstein's photoelectric equation , the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is

A. 

B. 

C. 

D. 

Answer: D

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10. A photosensitive metallic surface has work function , hv_0. If photons of enegy $2hv_0$ fall on this surface , the electrons come out with a maximum velocity of $4 \times 10^6 m/s$. When the velocity of photoelectrons will be

A. $2 \times 10^6 m/s$

B. $2 \times 10^7 m/s$

C. $8 \times 10^5 m/s$

D. $8 \times 10^6 m/s$

Answer: D

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

A. none

B. A only

C. A and B only

D. all the three medals

Answer: C

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12. When photons of energy hv fall on an aluminium plate (of work function E_0), photoelectrons of maximum kinetic energy K are ejected . If the frequency of the radiation is doubled , the maximum kinetic energy of the ejected photoelectrons will be

A. $K + E_0$

B. $2K$

C. K

D. $K + hv$

Answer: D

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13. In a discharge tube ionization of enclosed gas is produced due to collisions between

A. positive ions and neutral atoms//molecules

B. negative electrons and neutral atoms//molecules

C. photons and neutral atoms//molecules

D. neutral gas atoms//molecules

Answer: B

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14. A photocell employs photoelectric effect to convert

A. change in the frequency of light into a change in electric voltage

B. change in the intensity of illumination into a change into a change in photoelectric current

C. change in the intensity of illumination into a change in the work function of the photocathode

D. change in the frequency of light into a change in the electric current

Answer: B

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15. The momentum of a photon of energy $1MeV$ "in"kgm/s will be

A. 0.33×10^6

B. 7×10^{-24}

C. 10^{-22}

D. 5×10^{-22}

Answer: D

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16. Monochromatic light of frequency $6.0 \times 10^{14} Hz$ is produced by a laser. The power emitted is $2.0 \times 10^{-3} W$, (a) What is the energy of a photon in the light beam? (b) How many photons per second, on the average, are emitted by the source? Given $h = 6.63 \times 10^{-34} Js$

A. 5×10^{15}

B. 5×10^{16}

C. 5×10^{17}

D. 5×10^{14}

Answer: A

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17. A $5W$ source emits monochromatic light of wavelength 5000Å. When placed $0.5m$ away , it liberates photoelectrons from a photosensitive metallic surface . When the source is moved to a distance of $1.0m$, the number of photoelectrons liberated will be reduced by a factor of

A. 4

B. 8

C. 16

D. 2

Answer: A

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18. The work function of a surface of a photosensitive material is $6.2eV$. The wavelength of the incident radiation for which the stopping potential is $5V$ lies in the

A. ultraviolet region

B. visible region

C. infrared region

D. X - ray region

Answer: A

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19. In the phenomenon of electric discharge through gases at low pressure , the coloured glow in the tube appears as a result of

A. excitation of electrons in the atoms

B. collision between the atoms of the gas

C. collisions between the charged particles emitted from the cathode and the atoms of the gas

D. collisions between different electrons of the atoms of the gas

Answer: C

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20. A particle of mass $1mg$ has the same wavelength as an electron moving with a velocity of $3 \times 10^6 ms^{-1}$. The velocity of the particle is

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

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

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

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

Answer: A

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

A. $v - v_0$

B. threshold frequency (v_0)

C. intensity of light

D. frequency of light (v)

Answer: C

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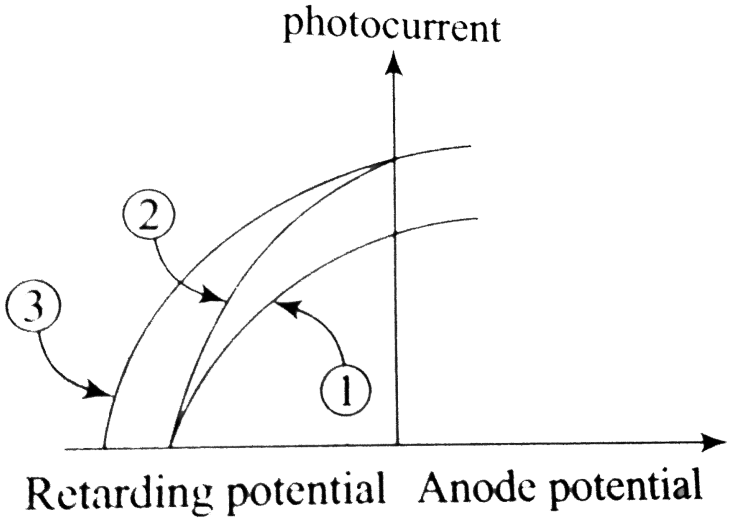
22. The figure shows a plot of photo current versus anode potential for a photosensitive surface for three different radiations. Which one of the

following is a correct statement ?



A. Curves a and b represent incident radiations of different frequencies and different intensities

B. Curves a and b represent incident radiations of the same frequency but no different intensities

C. Curves b and c represent incident radiations of different frequencies and different intensities

D. Curve b and c represent incident radiations of the same frequency having the same intensity

Answer: B

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23. Monochromatic light of wavelength $667nm$ is produced by a helium neon laser . The power emitted is $9mW$. The number of photons arriving per second on the average at a target irradiated by this beam is

A. 9×10^{17}

B. 3×10^{16}

C. 9×10^{15}

D. 3×10^{19}

Answer: B

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24. 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. 1.00

B. 1.02

C. 1.04

D. 0.98

Answer: A

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

A. $2.4V$

B. $-1.2V$

C. $-2.4V$

D. $1.2V$

Answer: D

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26. Photoelectric emission occurs only when the incident light has more than a certain minimum

A. wavelength

B. Intensity

C. frequency

D. power

Answer: C

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

A. increasing the filament current

B. decreasing the filament current

C. decreasing the potential difference between the anode and filament

D. increasing the potential difference between the anode and filament

Answer: D

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

A. $1:2$

B. $1:1$

C. $1:5$

D. $1:4$

Answer: A

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

A. decrease by 2 times

B. decrease by 4 times

C. increase by 4 times

D. increase by 2 times

Answer: A

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30. In photoelectric emission process from a metal of work function $1.8eV$, the kinetic energy of most energetic electrons is $0.5eV$. The corresponding stopping potential is

A. $1.3V$

B. $0.5V$

C. $2.3V$

D. $1.8V$

Answer: B

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31. The threshold frequency of a certain metal is $3.3 \times 10^{14} Hz$. If light of frequency $8.2 \times 10^{14} Hz$ is incident on the metal, predict the cut off voltage for photoelectric emission. Given Planck's constant, $h = 6.62 \times 10^{-34} Js$.

A. $2V$

B. $3V$

C. $5V$

D. $1V$

Answer: A

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32. A modern 200 W sodium street lamp emits yellow light of wavelength 0.6 μm. Assuming it to be 25% efficient in converting electrical energy to light, the number of photons of yellow light it emits per second is

A. 3×10^{19}

B. 1.5×10^{20}

C. 6×10^{18}

D. 62×10^{20}

Answer: B

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

A. $2.5 \times 10^{15} Hz$

B. $4 \times 10^{15} Hz$

C. $5 \times 10^{15} Hz$

D. $1.6 \times 10^{15} Hz$

Answer: D

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34. If the momentum of an electron is changed by p, then the de - Broglie wavelength associated with it changes by $0.5\,\%$. The initial momentum of electron will be

A. $200p$

B. $400p$

C. $\frac{p}{200}$

D. $100p$

Answer: A

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

A. $1:4$

B. $1:2$

C. $1:1$

D. $1:5$

Answer: B

Watch Video Solution

36. For photoelectric emission from certain metal the cut - off frequency is v. If radiation of frequency $2v$ impinges on the metal plate , the maximum possible velocity of the emitted electron will be (m is the electron mass).

A. $\sqrt{\frac{hv}{(2m)}}$

B. $\sqrt{\frac{hv}{m}}$

C. $\sqrt{\frac{2hv}{m}}$

D. $2\sqrt{\frac{hv}{m}}$

Answer: C

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37. The wavelength λ_e of an photon of same energy E are related by

A. $\lambda_p \propto \lambda_e^2$

B. $\lambda_p \propto \lambda_e$

C. $\lambda_p \propto \sqrt{\lambda_e}$

D. $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$

Answer: A

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38. 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. $0.65eV$

B. $1.0eV$

C. $1.3eV$

D. $1.5eV$

Answer: B

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39. If the kinetic energy of the particle is increased to 16 times its previous value , the percentage change in the de - Broglie wavelength of the particle is

A. 25

B. 75

C. 60

D. 50

Answer: B

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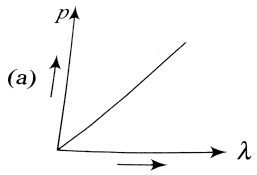
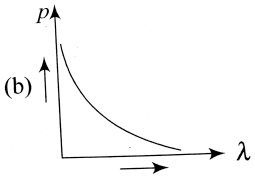
40. Which of the following figure represents the variation of particle momentum and the associated de - Broglie wavelength ?

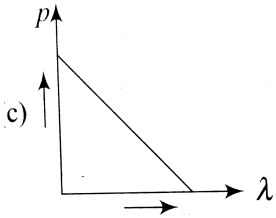
A.



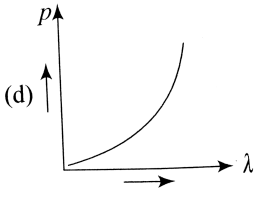
B.



C.



D.



Answer: B

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41. When a certain metallic surface is illuminated with monochromatic light of wavelength λ, the stopping potential for photoelectric current is $3V_0$ and when the same surface is illuminated with light of wavelength 2λ, the stopping potential is V_0. The threshold wavelength of this surface for photoelectric effect is

A. 6λ

B. 4λ

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

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

Answer: B

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42. Light of wavelength $500nm$ is incident on a metal with work function $2.28eV$. The de Broglie wavelength of the emitted electron is

A. $\leq 2.8 \times 10^{-12}m$

B. $< 2.8 \times 10^{-10}m$

C. $< 2.8 \times 10^{-9}m$

D. $\geq 2.8 \times 10^{-9}m$

Answer: D

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43. A photoelectric surface is illuminated successively by monochromatic light of wavelength λ and $\frac{\lambda}{2}$. If the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times than in the first case , the work function of the surface of the material is

$(h = Plank'scons\tan t, c = speedoflight)$

A. $\frac{hc}{3\lambda}$

B. $\frac{hc}{2\lambda}$

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

D. $\frac{2hc}{\lambda}$

Answer: B

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

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

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

C. $C(2mE)^{1/2}$

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

Answer: A

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45. When a metallic surface is illuminated with radiation of wavelength λ, the stopping potential is V. If the same surface is illuminated with radiation of wavelength 2λ , the stopping potential is $\frac{V}{4}$. The threshold wavelength surface is :

A. 3λ

B. 4λ

C. 5λ

D. $\frac{5}{2}\lambda$

Answer: A

Watch Video Solution

46. Electrons with de- Broglie wavelength λ fall on the target in an X- rays tube . The cut off wavelength of the emitted X- rays is

A. $\lambda_0 = \frac{2m^2c^2\lambda^3}{h^2}$

B. $\lambda_0 = \lambda$

C. $\lambda_0 = \frac{2mc\lambda^2}{h}$

D. $\lambda_0 = \frac{2h}{mc}$

Answer: C

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Aiims Questions

1. Photons with energy $5eV$ are incident on a cathode C in a photoelectric cell . The maximum energy of emitted photoelectrons is $2eV$. When photons of energy $6eV$ are incident on C , no photoelectrons will reach the anode A , if the stopping potential of A relative to C is

A. $-1V$

B. $-3V$

C. $+3V$

D. $+4V$

Answer: B

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2. The de - Broglie wavelength of a neutron in thermal equilibrium with heavy water at a temperature $T(\text{kelvin})$ and $massm$, is

A. $\frac{h}{\sqrt{(3mkT)}}$

B. $\frac{2h}{\sqrt{(3mkT)}}$

C. $\frac{2h}{\sqrt{(mkT)}}$

D. $\frac{h}{\sqrt{(mkT)}}$

Answer: A

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3. The photoelectric threshold wavelength of silver is $3250 \times 10^{-10} m$. The velocity of the electron ejected from a silver surface by ultraviolet light of wavelength $2536 \times 10^{-10} m$ is $(Given h = 4.14 \times 10^{6} ms^{-1} eVs$ and $c = 3 \times 10^{8} ms^{-1})$

A. $\approx 0.6 \times 10^{6} ms^{-1}$

B. $\approx 61 \times 10^{3} ms^{-1}$

C. $\approx 0.3 \times 10^{6} ms^{-1}$

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

Answer: A::D

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4. 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.

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: B

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5. An electron of mass m with an initial velocity

$\overrightarrow{v} = v_0$ˆ(i) $(v_0 > 0)$ enters an electric field

$\overrightarrow{E} = v_0\hat{i}$(E_(0) = constant gt 0)$att$ = 0. Iflambda_(0)

$isitsde - Brogliewave \leq n > h \in itially, thenitsde - Brogliewave \leq n$

t` is

A. λ_0

B. $\dfrac{\lambda_0}{\left(1 + \frac{eE_0}{mv_0}t\right)}$

C. $\lambda_0 t$

D. $\lambda_0\left(1 + \dfrac{eE_0}{mv_0}t\right)$

Answer: B

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6. Fraunhofer line of the solar system is an example of

A. line absorption spectrum

B. band absorption spectrum

C. line emission spectrum

D. band emission spectrum

Answer: A

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7. The speed of an electron having a wavelength of $10^{-10}m$ is

A. $4.24 \times 10^6 m/s$

B. $5.25 \times 10^6 m/s$

C. $7.25 \times 10^6 m/s$

D. $6.25 \times 10^6 m/s$

Answer: C

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8. Ligth of wavelength 4000Å is incident on a metal plate whose work function is $2eV$. What is maximum kinetic enegy of emitted photoelectron ?

A. $2.0eV$

B. $1.1eV$

C. $0.5eV$

D. $1.5eV$

Answer: B

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9. A laser beam is used for carrying our surgery because it

A. is highly monochromatic

B. is highly coherent

C. can be sharply focussed

D. is highly directional

Answer: C

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10. A proton is about 1840 times heavier than an electron. When it is accelerated by a potential difference of $1kV$. Its kinetic energy will be

A. $1840keV$

B. $1keV$

C. $1/1840keV$

D. $920keV$

Answer: B

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11. If an electron and a photon propagate in the form of waves having the same wavelength , it implies that they have the same

A. momentum

B. energy

C. velocity

D. angular momentum

Answer: A

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12. A photon of energy $4eV$ is incident on a metal surface whose work function is $2eV$. The minimum reverse potential to be applied for stopping the emission of electrons is

A. $6V$

B. $4V$

C. $2V$

D. $8V$

Answer: C

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13. We wish to see inside an atom. Assuming the atom to have a diameter of $100 \pm$, this means that one must be able to resolve a width of say $10 \pm$. If an electron microscope is used, the minimum electron energy required is about

A. $15keV$

B. $1.5keV$

C. $150keV$

D. $1.5MeV$

Answer: A

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14. Solid targets of different elements are bombarded by highly energetic electron beam. The frequcny (f) of the characteristic X-rays emitted from different targets varies with atomic number Z as

A. $f \propto \sqrt{Z}$

B. $f \propto Z^2$

C. $f \propto Z$

D. $f \propto Z^{3/2}$

Answer: B

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15. The radiation pressure exerted by an EM wave of intensity I on a black body's surface kept in vacuum is

A. I/c

B. Ic^2

C. Ic

D. I/c^2

Answer: A

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16. Hard X -rays for the study of fractures in bones should have a minimum wavelength of $10^{-11}m$. The accelerating voltage for electrons in X -ray machine should be

A. $> 124kV$

B. $< 124kV$

C. between $60kV$ and $70kV$

D. $= 100kV$

Answer: B

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17. Photoelectric emission occurs only when the incident light has more than a certain minimum

A. wavelength

B. frequency

C. amplitude

D. angle of incidence

Answer: B

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18. If alpha,beta and gamma rays carry same momentum, which has the longest wavelength ?

A. None, all have same wavelength

B. Alpha rays

C. Beta Rays

D. Gamma rays

Answer: A

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19. Flash light equipped with a new set of batteries, produces bright white light. As the batteries wear out

A. the light intensity gets reduced with no change in its colour

B. colour changes to red and also intensity gets reduced

C. light colour changes first to yellow and then red with no change in intensity

D. it stops working suddenly while giving white light

Answer: B

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20. Radiation of wavelength λ in indent on a photocell . The fastest emitted electron has speed v if the wavelength is changed to $\frac{3\lambda}{4}$, then speed of the fastest emitted electron will be

A. $v\left(\frac{3}{4}\right)^{1/2}$

B. $v\left(\frac{4}{3}\right)^{1/2}$

C. $< v\left(\frac{4}{3}\right)^{1/2}$

D. $> v\left(\frac{4}{(3)^{1/2}}\right.$

Answer: D

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21. Penetrating power of X - rays depends on

A. current flowing in the filament

B. applied potential difference

C. nature of the target

D. all the above

Answer: B

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22. Ultraviolet light of wavelength 300nn and intensity $1.0Wm^{-2}$ falls on the surface of a photosensitive material. If one per cent of the incident photons produce photoelectrons, then the number of photoelectrons emitted per second from an area of 1.0 cm^2 of the surface is nearly

A. $9.6 \times 10^{14} per \sec$

B. $4.12 \times 10^{13} per \sec$

C. $1.51 \times 10^{12} per \sec$

D. $2.13 \times 10^{11} per \sec$

Answer: C

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

A. double the earlier value

B. unchanged

C. more than doubled

D. less than doubled

Answer: C

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24. The potential difference applied to an X-ray tube is 5k V and the current through it is 3.2 mA. Then, the number of electrons striking the

target per second is. (a) 2×10^{16} (b) 5×10^{6} (c) 1×10^{17} (d) 4×10^{15}.

A. 2×10^{16}

B. 5×10^{16}

C. 1×10^{17}

D. 4×10^{15}

Answer: A

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25. 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 on the intensity of the radiation

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

D. depends on the nature of the metals used

Answer: A

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26. The wavelength of K_α line for an element of atomic number $43 is \lambda$. Then the wavelength of K_α line for an element of atomic number 29 is

A. $\frac{43}{29}\lambda$

B. $\frac{42}{28}\lambda$

C. $\frac{9}{4}\lambda$

D. $\frac{4}{9}\lambda$

Answer: C

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27. 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 $0.6V$ and $18.0mA$ if the same source is placed $0.6m$ away from the photoelectric cell , then

A. the stopping potential will be $0.2V$

B. the stopping potential will be $0.6V$

C. the saturation current will be $6mA$

D. the saturation current will be $18mA$

Answer: B

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28. The de - Broglie wavelength of a particle moving with a velocity $2.25 \times 10^8 m/s$ is equal to the wavelength of photon. The ratio of kinetic energy of the particle to the energy of the photon is (velocity of light is $3 \times 10^8 m/s$

A. $1/8$

B. $3/8$

C. $5/8$

D. $7/8$

Answer: B

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29. A photo cell is receiving light from a source placed at a distance of $1m$. If the same source is to be placed at a distance of $2m$, then the ejected electron

A. Moves with one - fourth energy as that of the initial energy

B. Moves with one - fourth of momentum as that of the initial momentum

C. will be half in number

D. will be one - fourth in number

Answer: D

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30. Light of wavelength λ strikes a photo - sensitive surface and electrons are ejected with kinetic energy is to be increased to $2E$, the wavelength must be changed to λ' where

A. $\lambda' = \frac{\lambda}{2}$

B. $\lambda' = 2\lambda$

C. $\frac{\lambda}{2} < \lambda' < \lambda$

D. $\lambda' = \lambda$

Answer: C

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31. Two identical metal plates show photoelectric effect by a light of wavelength λ_A falls on plate A and λ_B on plate $B(\lambda_A = 2\lambda_B)$. The maximum kinetic energy is

A. $2K_A = K_B$

B. $K_A < K_B/2$

C. $K_A = 2K_B$

D. $K_A = K_B/2$

Answer: B

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32. Find the minimum wavelngth of X - ray emitted by X - ray tube , which is operating at $15kV$ accelerating voltage.

A. 0.75Å

B. 0.82Å

C. 1.42Å

D. 1.13Å

Answer: B

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Assertion Reason

1. Assertion : X - rays travel with the speed of light.

Reason : X- rays are electromagnetic rays.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: A

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2. Assertion : When the speed of an electron increases its specific charge decreases.

Reason : Specific charge is the ratio of the change to mass.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: B

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3. Assertion : In photoelctric effect , on increasing the intensity of light , both the number of electrons emitted and kinetic energy of each of them get increased but photoelectric current remains unchanged.

Reason : The photoelectric current depends only on wavelength of light .

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: D

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4. Assertion : Photoelectric effect demonstrates the wave nature of light.

Reason: The number of photoelectrons is proportional to the frequency of light.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: D

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5. Assertion : The energy (E) and momentum (p) of a photon are related by $p = E/c$.

Reason : The photon behaves like a particle.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: A

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6. Assertion : The threshold frequency of photoelectric effect supports the particle nature of sunlight .

Reason : If frequency of incident light is less than the threshold frequency , electrons are not emitted from metal surface.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: B

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7. Assertion : Mass of moving photon varies inversely as the wavelength .

Reason : Energy of the particle $= Mass \times (Speed of light)^2$

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: B

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8. Assertion : Kinetic energy of photo electrons emitted by a photosensitive surface depends upon the intensity of incident photon.

Reason : The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: D

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9. Assertion : Isotope is possible because of the using a mass spectrometer.

Reason : Separation of isotope is possible because of the difference in electron number of isotope.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: C

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10. Assertion : The specific charge of positive rays is not constant.

Reason : The mass of ions varies with speed.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: B

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11. Assertion : Photosensitivity of a metal is high if its work function is small.

Reason : Work function $= hf_0$ where f_0 is the threshold frequency.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: B

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12. Assertion : The de - Broglie wavelength of a molecule varies inversely as the square root of temperature.

Reason : The root mean square velocity of the molecule depends on the temperature.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: A

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13. Assertion : X - rays can penetrate through the flesh but not through the bones.

Reason : The penetrating power of X - rays depends on voltage.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: B

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14. Assertion : Though light of a single frequency (monochromatic) is incident on a metal , the energies of emitted photoelectrons are different.

Reason : The energy of electrons emitted from inside the metal surface is lost in collision with the other atoms in the metal.

A. If both assertion and reason are true and reason is the correct explanation of the assertion.

B. If both assertion and reason are true but reason is not correct explanation of the assertion.

C. If assertion is true but the reason is false.

D. If both the assertion and reason are false.

Answer: A

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Section D Chapter End Test

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

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

B. $\frac{hv}{c}$

C. $\frac{hc}{c^2}$

D. hv

Answer: A

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

A. $1:5$

B. $1:4$

C. $1:2$

D. $1:1$

Answer: B

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3. Sodium and copper have work functions $2.3eV$ and $4.5eV$ respectively . Then the ratio of the wavelength is nearest

A. $1:2$

B. $4:10$

C. $2:1$

D. $1:4$

Answer: C

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4. Two identical photocathodes receive light of frequency f_1 and f_2 if the velocites of the photo electrons (of mass m) coming out are repectively v_1 and v_2 then

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

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

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

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

Answer: B

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5. The work function of a substance is $4.0eV$. The longest wavelength of light that can cause photo electron emission from this substance is approximately. (a) $540nm$ (b) $400nm$ (c) $310nm$ (d) $220nm$

A. $540nm$

B. $400nm$

C. $310nm$

D. $220nm$

Answer: C

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6. 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 on the intensity of the radiation

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

D. depends on the nature of the metals used

Answer: A

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7. A photocell is illuminated by a small bright source places 1 m away when the same source of light is placed $\frac{1}{2}$ m away. The number of electron emitted by photocathode would be

A. Decrease by a factor of 2

B. Increase by a factor of 2

C. Decrease by a factor of 4

D. Increase by a factor of 4

Answer: D

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

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

B. $\sqrt{2}$

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

D. 2

Answer: A

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9. In a photoelectric effect , the $K.E.$ of electrons emitted from the metal surface depends upon

A. Intensity of light

B. Frequency of the incident light

C. Velocity of incident light

D. Both intensity and velocity of light

Answer: B

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10. The photoelectric effect can be understood on the basis of

A. The principle of superposition

B. The electromagnetic theory of light

C. The special theory of relativity

D. Line spectrum of the atom

Answer: D

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11. If the threshold wavelength for sodium is 5420Å, then the work function of sodium is

A. $4.58eV$

B. $2.28eV$

C. $1.14eV$

D. $0.23eV$

Answer: B

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12. The magnitude of saturation photoelectric current depends upon

A. Frequency

B. Intensity

C. Work function

D. Stopping potential

Answer: B

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13. For photoelectric emission , tungsten requires light of 2300Å. If light of 1800Å wavelength is incident then emission

A. Takes place

B. Don't take place

C. May or may not take place

D. Depends on frequency

Answer: A

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14. The light rays having photons of energy $1.8eV$ are falling on a metal surface having a work function $1.2eV$. What is the stopping potential to be applied to stop the emitting electrons ?

A. $3eV$

B. $1.2eV$

C. $0.6eV$

D. $1.4eV$

Answer: C

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15. A photon of energy $8eV$ is incident on metal surface of threshold frequency $1.6 \times 10^{15} Hz$, The maximum kinetic energy of the photoelectrons emitted (in eV) (Take $h = 6 \times 10^{-34} Js$).

A. 1.6

B. 6

C. 2

D. 1.2

Answer: A

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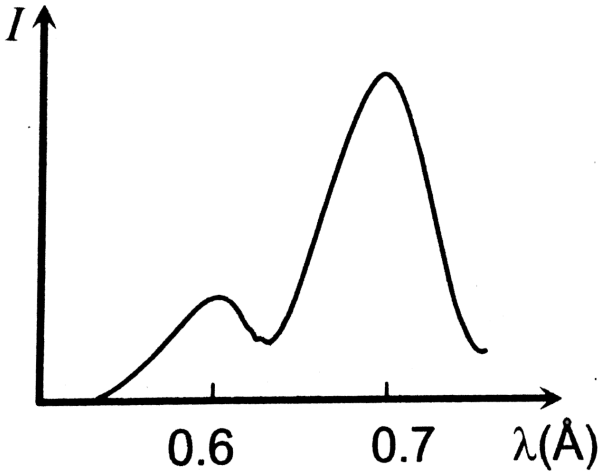
16. In the diagram a graph between the intensity of X-rays emitted by a molybdenum target and the wavelength is shown , when electrons of $30keV$ are incident on the target. In th egraph one peak is of K_α line and the other peak is of K_β line



A. First peak is of K_α line at 0.6Å

B. Highest peak is of K_α line at 0.7Å

C. If the energy of incident particles is increased , then the peaks will shift towards left

D. If the energy of incident particles is increased , then the peaks will shift towards right

Answer: B

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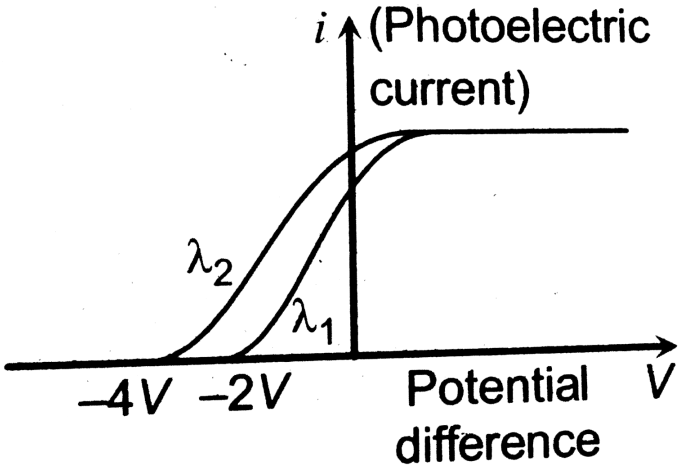
17. The maximum value of stopping potential in the following diagram is



A. $-4V$

B. $-1V$

C. $-3V$

D. $-2V$

Answer: A

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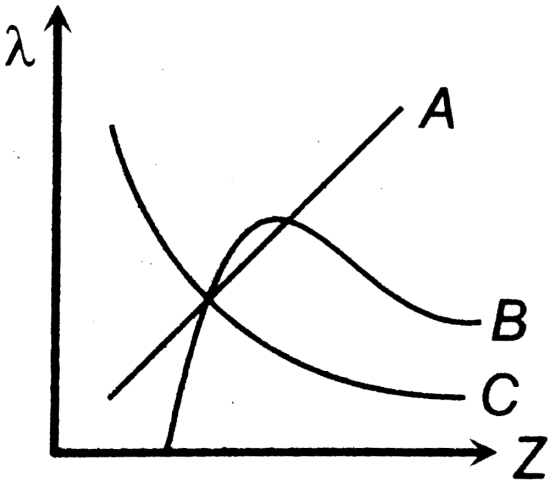
18. The variation of wavelength λ of the K_α line with atomic number Z of the target is shown by the following curve of



A. A

B. B

C. C

D. None of these

Answer: C

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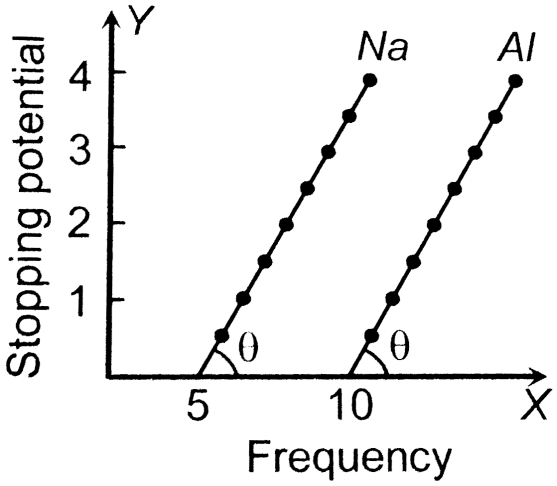
19. From the figure describing photoelectric effect we may infer correctly that



A. Na and Al both have the same threshold frequency

B. Maximum kinetic energy for both the metals depend linearly on the frequency

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

D. Al ia a better photo sensitive material than Na

Answer: B

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

A. Photo - electric current is decreased

B. Photo - electric current is increased

C. Photo - electric current remains the same

D. Decrease or increase in photo - electric in photo - electric current does not depend upon the gas filled

Answer: B

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21. A photon of $1.7 \times 10^{-13} joe\underline{s}$ is absorbed by a material under special circumstances. The correct statement is

A. Electrons of the atom of absorbed material will go the higher energy states

B. Electron and position pair will be created

C. Only position will be produced

D. Photoelectric effect will occur and electron will be produced

Answer: B

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

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

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

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

Answer: B

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23. 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 stopping potential will be $0.2V$

B. the stopping potential will be $0.6V$

C. the saturation current will be $6mA$

D. the saturation current will be $18mA$

Answer: C

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24. Which of the following has the least value of $\frac{q}{m}$?

A. Electron

B. Proton

C. α - particles

D. `beta -particle

Answer: B

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25. When green light is incident on the surface of metal , it emits photo - electrons but there is no such emission with yellow colour light. Which one of the colours can produce emission of photo - electrons ?

A. Orange

B. Red

C. Indigo

D. None of the above

Answer: C

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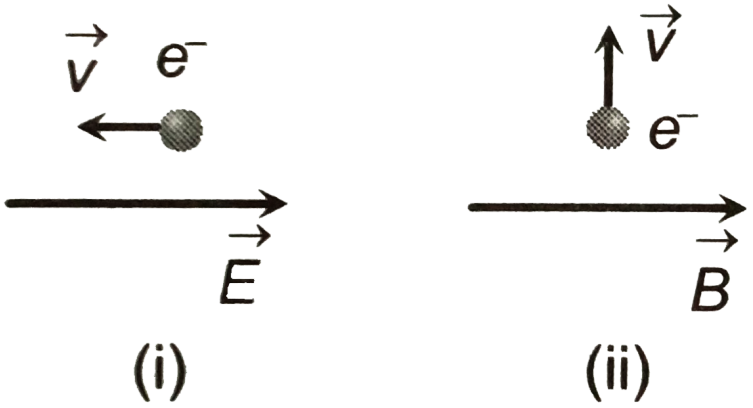
26. An electron is moving through a field. It is moving (i) opposite an electric field (ii) perpendicular to a magnetic field as shown. For each

situation the de - Broglie wave length of electron



A. increasing , increasing

B. Increasing , decreasing

C. Decreasing , same

D. Same , same

Answer: C

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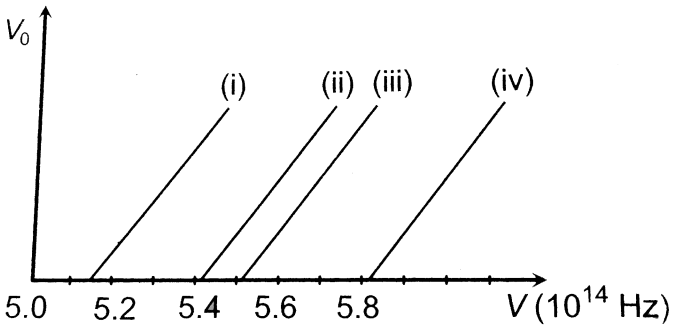
27. The figure shows different graphs between stopping potential (V_0) and frequency (v) for photosensitive surface of cesium , potassium ,

sodium and lithium. The plots are parallel. Correct ranking of the targets according to their work function greatest first will be



A. $(i) > (ii) > (iii) > (iv)$

B. $(i) > (iii) > (ii) > (iv)$

C. $(iv) > (iii) > (ii) = (iv)$

D. $(i) = (iii) > (ii) = (iv)$

Answer: C

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28. The K_α X - rays arising from a cobalt $(z = 27)$ target have a wavelength of $179 \pm$. The K_α X - rays arising from a nickel target

$(z = 28)$ is

A. $> 179 \pm$

B. $< 179 \pm$

C. $= 179 \pm$

D. None of these

Answer: B

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29. Assertion : In the process of photoelectric emission , all the emitted photoelectrons have the same kinetic energy.

Reason : The photon transfers its whole energy to the electron of the atom in photoelectric effect.

A. If both assertion and reason are true and the reason is the correct explanation explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

Answer: D

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30. Assertion : Soft and hard X-rays differ in frequency as well as velocity. Reason : The penetrating power of hard X- rays is more than the penetrating power of soft X-rays.

A. If both assertion and reason are true and the reason is the correct explanation explanation of assertion.

B. If both assertion and reason are true but reason is not the correct explanation of assertion.

C. If assertion is true but reason is false.

D. If assertion is false but reason is true.

Answer: D