PHYSICS

BOOKS - AAKASH SERIES

DUAL NATURE OF RADIATION AND MATTER

Problem

1. A monochromatic source of light operating at 200W emits 4×10^{20} photons per second. Find the wavelength

of the light.

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2. Will photoelectrons be emitted from a copper surface, of work function $4.4eV$, when illuminated by a visible light?

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3. The photoelectric work - function of potassium is 2.3 eV. If light

having a wavelength of 2800Å falls on potassium, find

(a) the kinetic energy in electron volts of the most energetic electrons ejected.

(b) the stopping potential in volts.

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4. The work function of a metal is 3.0 V. It is illuminated by a light of wave length $3 \times 10^{-7} m$. Calculate i) threshold frequency, ii) the maximum energy of photoelectrons, iii) the stopping potential.

$\left(h = 6.63 \times 10^{-34} Js \text{ and } c = 3 \times 10^{8} ms^{-}\right).$

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5. The work function of a photosensitive element is 2eV. Calculate the velocity of a photoelectron when the element is exposed to a light of wavelength 4×10^{3} A.

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6. A metal of work function 4eV is exposed to a radiation of wavelength 140×10^{-9} m. Find the stopping potential developed by it.

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7. If 5% of the energy supplied to an incandescent light bulb is radiated as visible light, how may visible light photons are emitted by a 100W bulb? Assume the average wavelength of all visible photons to be 5600Å. Given $h = 6.25 \times 10^{-34} Js$.

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8. Monochromatic light of wavelength 632.8 nm is produced by a helium-neon laser. The power emitted is 9.42 mW

(a) Find the energy and momentum of each photon in the light beam,

(b) How many photons per second, on the average, arrive at a targetirradiated by this beam? (Assume the beam to have uniform cross-section which is less than the target area), and

(c) How fast does a hydrogen atom have to travel in order to have the same momentum as that of the photon?

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

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

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11. When a beam of 10.6 eV photons of intensity 2.0 W/m^2 falls on a platinum surface of area $1.0 \times 10^{-4} m^2$ and photons eject photoelectrons. Find the number of photoelectrons emitted per second

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12. A radiation of wavelength 200nm is propagating in the form of a parallel surface. The power of the beam is 5mW and its cross-sectional area is $1.0 mm^2$. Find the pressure exerted by radiation on the metallic surface if the radiation is completely reflected.

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

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14. Light of wavelength 2475 Å is incident on barium . Photo electrons emitted describe a circle of radius 100 cm by a magnetic field of flux density $\frac{1}{\sqrt{17}} \times 10^{-5}$ tesla. Find the work function of the barium . (Given $\frac{e}{m} = 1.7 \times 10^{11}$)

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15. A monochromatic light of wavelength λ is incident on an isolated metallic sphere of radius a. The threshold wavelength is λ_0 which is larger than λ. Find the number of photoelectrons emitted before the emission of photoelectrons will stop.

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16. Light described at a place by the equation $E = \left(100\frac{V}{m}\right)\left[\sin\left(5 \times 10^{15} s^{-1}\right)t + \sin\left(8 \times 10^{15} s^{-1}\right)t\right]$ falls on a metal surface having work function 2.0 eV.

Calculate the maximum kinetic energy of the photoelectrons.

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17. A small metal plate is kept at a distance d form a singly ionized, fixed ion. A monochromatic light beam is incident on the metal plate and photoelectrons are emitted. Find the maximum wavelength of the light beam so that some of the photoelectrons may go round the ion along a circle.

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18. An electron is accelerated through a potential difference of V volt. Find the de-Broglie wavelength associated with electron.

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19. Find the ratio of de Broglie wavelength of molecules of hydrogen and helium which are at temperatures $27^\circ \quad \text{and} \quad 127^\circ C$ respectively

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20. An α-particle and a proton are fired through the same magnetic field which is perpendicular to their velocity vectors. The α-partcles and the proton move such that radius of curvature of their paths is same. Find the ratio of their de Broglie wavelengths.

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21. Electrons of mass m with de-Broglie wavelength λ fall on the target in an X-ray tube. The cut-off wavelength (λ_0) of the emitted X-ray is

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22. With what velocity must an electron travel so that its momentum is equal to that of a photon with a wavelength of $5000 Å \left(h = 6.6 \times 10^{-34} Js, m_e = 9.1 \times 10^{-31}\right.$ Kg)

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23. Calculate the uncertainty in position of the electron if de-Broglie wavelength associated with electron is $7.2 Å (0.01\,\% -$ error is involved in measurement of velocity) . (Mass of electron $= 9.1 \times 10^{-31} kg\big)$

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24. When photon oFIGURE energy 4.0eV strikes the surFIGUREace oFIGURE a metal, the ejected photoelectrons have maximum kinetic energy T_A eV and de-Broglie wavelength λ_A. The maximum kinetic energy oFIGURE photoelectrons liberated FIGUREom another metal B by photon oFIGURE energy 4.50eV is $T_B = (T_1 - 1.5)eV$. IFIGURE the de-Broglie wavelength oFIGURE these photoelectrons $\lambda_B = 2\lambda_A$, then the work, FIGUREunction oFIGURE metal B is:

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Exercise I

1. When stopping potential is applied in an experiment on photoelectric effect, no photocurrent is observed. This means that

A. The emission of photo electrons is stopped

B. The photoelectrons are emitted but are reabsorbed by the emitter

C. The photoelectrons are accumulated near the collector

D. The photoelectrons are dispersed from the sides of the apparatus

Answer: B

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2. If the frequency of incident light is tripled, the stopping potential will

A. be tripled

B. become one third

C. become more than triple

D. become less than triple but more than double

Answer: C

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3. A nonmonochromatic light is used in an experiment on photoelectric effect. The stopping potential

A. Mean wave length

B. Longest wave length

C. Shortest wave length

D. Distance of the source from the metal

Answer: C

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4. Photoelectric effect supports quantum nature of light because

A. There is a minimum frequency below which no photo electrons are emitted

B. The maximum KE of photo electron depend only on the frequency of light and not on its intensity

C. Even when the metal surface is faintly illuminated the photo electrons leave the surface immediately

D. All the above

Answer: D

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5. If the wave length of light in an experiment on photo electric effect is doubled keeping the intensity constant

A. The photo electrons may or may not be emitted

B. The stopping potential decreases if electrons are emitted

C. The photo electric current does not change if electrons are emitted

D. All the above

Answer: D

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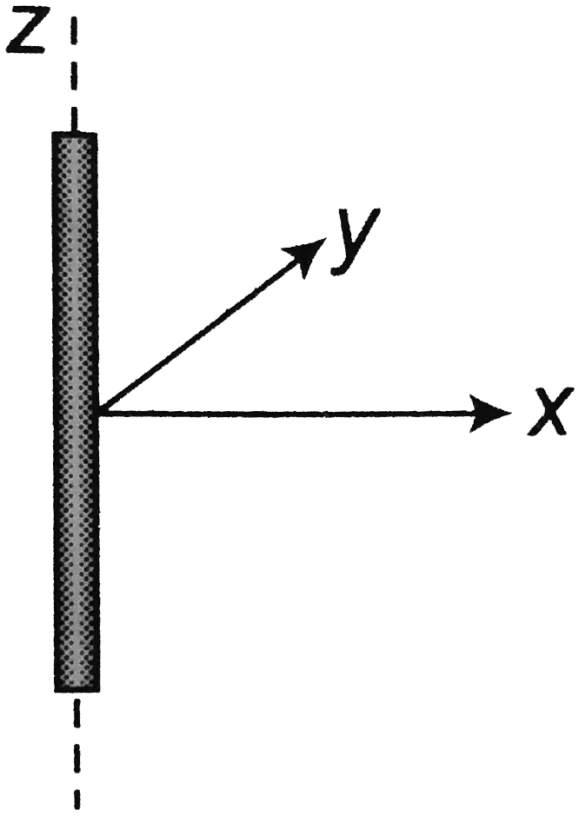
6. An infinitely long wire is kept along z-axis from $z = -\infty$ to $z = \infty$, having uniform linear charge density $\frac{10}{9} nC/m$. The electric field at point $(6cm, 8cm, 10cm)$ will be



A. Does not obey Ohm.s law

B. Does not depend on exposure time

C. Does not depend on frequency of incident light

D. All the above

Answer: D

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7. Assertion: The ferromagnetic substances do not obey Curie's law.

Reason: At Curie point ferromagnetic substances start behaving as a paramagnetic substances start behaving as a paramagnetic substances.

A. Nickel

B. Sodium

C. Cesium

D. Potassium

Answer: C

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8. Blue light can eject photo electron from a photo sensitive surface while orange light cannot. Then

A. Violet light can eject electron

B. Red light can not eject electron

C.

D. All the above

Answer: D

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9. Intensity of light incident on a photo sensitive surface is doubled. Then

A. A) the number of emitted electrons is tripled

B. B) the number of emitted electrons is doubled

C. C) the K.E. of emitted electrons is doubled

D. D) the momentum of emitted electrons is doubled

Answer: B

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10. Light of wavelengths λ falls on a metal having work function $\frac{hc}{\lambda_0}$. Photoelectric effect will take place only

A. $\lambda \geq \lambda_0$

B. $\lambda \geq 2\lambda_0$

C. $\lambda \leq \lambda_0$

D. $\lambda \leq \lambda_0 / 2$

Answer: C

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11. When orange light falls on a photo sensitive surfaces the photo current begins to flow. The velocity of emitted electrons will be more when surface is hit by

A. A) Red light

B. B) Violet light

C. C) Thermal radiations

D. D) Radio waves

Answer: B

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12. The cathode of a photoelectric cell is changed such that the work function changes from W_1 to $W_2(W_2 > W_1)$. If the current before and after changes 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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13. Stopping potential depends on planks constant (h), current (I), universal gravitational constant (G) and speed of light (C) choose the correct option for the dimension of stopping potential (V).

A. Frequency of incident light

B. Intensity of incident light

C. Number of emitted electrons

D. Number of incident photons

Answer: A

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14. Assertion : Photoelectric current depends on the intensity of incident light.

Reason : Number of photoelectrons emitted per second is directly proportional to intensity of incident radiation.

A. Work function

B. Frequency of radiations

C. Intensity of radiation

D. Stopping potential

Answer: C

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15. An electrochemical cell converts _____ energy to _____ energy.

A. Light energy into heat energy

B. Light energy into sound energy

C. Light energy into electrical energy

D. Electrical energy into light energy

Answer: C

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16. Dendogram is based on

A. Thermoelectricity

B. Photo electricity

C. Photo synthesis

D. Photography

Answer: B

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17. For the oxidation of ferric oxalate to CO_2, $18F$ of electricity is required. How many moles of ferric oxalate is oxidized ?

A. Exposure meter

B. automatic doors

C. Reproduction of sound in movies

D. All the above

Answer: D

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18. Photo electric effect can be explained only by assuming that light

A. is a form of transverse waves

B..is a form of longitudnal waves

C..can be polarised

D. consists of quanta

A. is a form of transverse waves

B. is a form of longitudinal waves

C. can be polarized

D. consists of quanta

Answer: D

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19. Consider the two following statements I and II, and identify the correct choice given in the answers

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

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

A. Both A & B are true

B. Both A & B are false

C. A is true but B is false

D. A is false but B is true

Answer: D

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20. The number of electrons emitted by a surface exposed to light is directly proportional to

A. Frequency of light

B. Work function of metal

C. Threshold wave length

D. Intensity of light

Answer: D

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21. A 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. The intensity of incident radiation

B. The frequency of incident radiation

C. The velocity of incident radiation

D. The work function of photo cathode

Answer: A

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22. According to Einstein's photoelectric equation, the graph of kinetic energy of the photoelectron emitted

from the metal versus the frequency of the incident radiation gives a straight line graph line graph, whose slope

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

B. depends on the intensity of the radiation

C. depends on the nature of the metal used

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

Answer: D

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23. A photocell is illuminated by a small bright source placed 1 m away . When the same source of light is placed $(1/2)$ m away , the photocathode would

A. increases by a factor 4

B. decreases by a factor 4

C. increases by a factor 2

D. decreases by a factor 2

Answer: A

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24. Assertion : Photoelectric effect supports the quantum nature of light.

Reason : Photoelectric emission is instantaneous.

A. A is true, B is false

B. A is true, B is true

C. A is false, B is true

D. A is false, B is false

Answer: A

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25. Pick out wrong statement

A. Photoelectric current increases with increase in accelerating potential until it becomes maximum value.

B. High voltage spark passed across electrodes in a discharge tube if they are illuminated by ultraviolet light.

C. To study the effect of potential on photoelectric current, we first maintain collector at same positive potential with respect to emitter.

D. The maximum negative potential given to collector for which photoelectric current becomes zero is called stopping potential.

Answer: D

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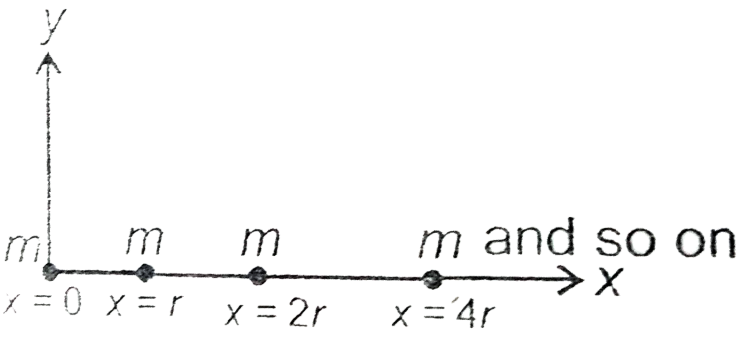
26. Consider an infinite distribution of point masses (each of mass m) placed on x-axis as shown in the diagram. What is the gravitational force acting on the point mass placed at the origin ?



A. Only a,b are correct

B. Only b,c are correct

C. All are correct

D. All are wrong

Answer: C

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27. Statement (A): Every photon striking the metal and colliding with the electron uses part of its energy to remove the electron from the metal surface, the remaining part is used to impart K.E. to the electron.

Statement (B): The minimum energy needed to remove the electron from the metal surface is called work

function.

Statement (C): There is no time lag between incidence of photon and emission of photoelectrons.

A. A, B are only true

B. B, C are only true

C. A, C are only true

D. A, B, C are true

Answer: B

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28. The slope of the graph drawn between stopping potential and frequency of incident radiation will be

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

B. he

C. eh^2

D. e^2h

Answer: A

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29. The principle of photo cell is

A. To convert electrical energy into light energy

B. To convert light energy into electrical energy

C. To convert light energy into heat energy

D. To convert electrical energy into heat energy

Answer: B

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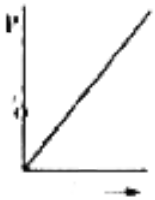
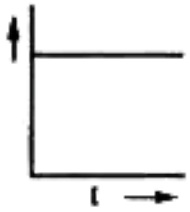
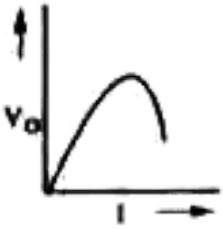
30. The correct statement is :



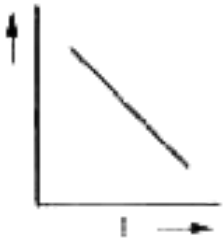
A.



B.



C.



D.

Answer: A

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31. Flowers are unisexual in :

A. Light meters

B. Street light electric circuits

C. Burglar alarm

D. Automatic opening and close of doors.

Answer: C

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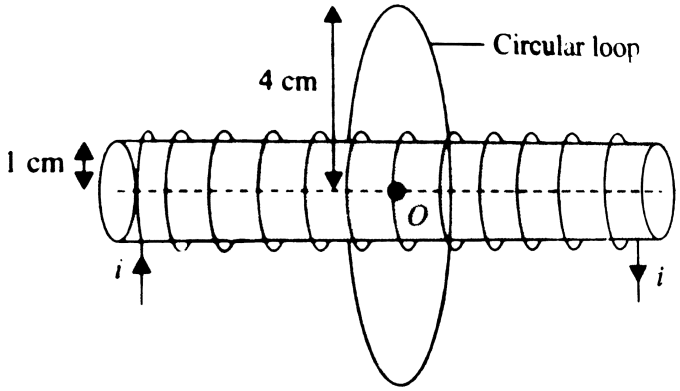
32. A long solenoid having n = 200 turns per metre has a circular cross-section of radius $a_1 = 1cm$. A circular conducting loop of radius $a_2 = 4cm$ and resistance

$R = 5(\Omega)$ encircles the solenoid such that the centre of circular loop coincides with the midpoint of the axial line of the solenoid and they have the same axis as shown in Fig.

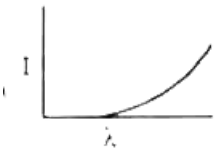


A current 't' in the solenoid results in magnetic field along its axis with magnitude $B = (\mu)ni$ at points well inside the solenoid on its axis. We can neglect the insignificant field outside the solenoid. This results in a magnetic flux $(\phi)_B$ through the circular loop. If the current in the winding of solenoid is changed, it will

also change the magnetic field $B = (\mu)_0 ni$ and hence also the magnetic flux through the circular loop. Obvisouly, it will result in an induced emf or induced electric field in the circular loop and an induced current will appear in the loop. Let current in the winding of solenoid be reduced at a rate of $75A/\sec.$

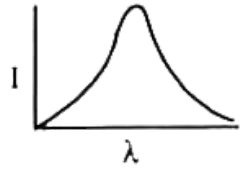
When the current in the solenoid becomes zero so that external magnetic field for the loop stops changing, current in the loop will follow a differenctial equation given by [You may use an approximation that field at all points in the area of loop is the same as at the centre

A.

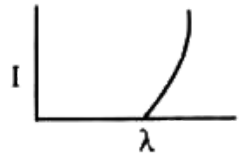


B.

C.



D.



Answer: B

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33. The threshold frequency for a metallic surface corresponds to an energy of 6.2 eV and the stopping

potential for a radiation incident on this surfance is 5 V.

The incident radiation lies in

A. ultraviolet region

B. infrared region

C. visible region

D. X- ray region

Answer: A

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34. The mass of electron varies with

A. electron velocity

B. the size of cathode ray tube

C. variation of g

D. the size of electron

Answer: A

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35. The wavelengths of a photon, an electron and a uranium nucleus are same. Maximum energy will be of

A. photon

B. electron

C. it will depend on their properties and wavelength

D. uranium nucleus

Answer: A

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36. The matter waves are

A. Light waves

B. Sound waves

C. Stationary waves

D. Probabilistic waves

Answer: D

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37. The wave nature of electron is verified by

A. Photoelectric effect

B. Compton effect

C. the incidence of electron on metallic surface

D. diffraction of electron by crystal.

Answer: D

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38. The De- broglie wavelength associated with a matter particle is

A. more

B. larger

C. same

D. more for light particles and less for heavy particles

Answer: A

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39. The ratio of wavelength of a photon and that of an electron of same energy E will be

A. $\sqrt{\frac{2m}{E}}$

B. $\sqrt{\frac{E}{2m}}$

C. $\sqrt{\frac{2m}{E}}c$

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

Answer: C

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40. Enthalpy change of a reaction with be equal to

A. equal to the kinetic energy of the particle

B. less than the kinetic energy of particle

C. equal to the total energy of the particle

D. more than the kinetic energy of the particle

Answer: D

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41. Calculate the uncertainty in position of the electron if de-Broglie wavelength associated with electron is $7.2Å(0.01\ \% -$ error is involved in measurement of velocity) . (Mass of electron $= 9.1 \times 10^{-31} kg)$

A. 2

B. $1/2$

C. $\sqrt{2}$

D. $\frac{1}{\sqrt{3}}$

Answer: D

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42. The Phenomena of photoelectric effect and Compton effect will conform

A. Wave theory of light

B. Particle nature of light

C. Dual nature of light

D. Electromagnetic theory

Answer: B

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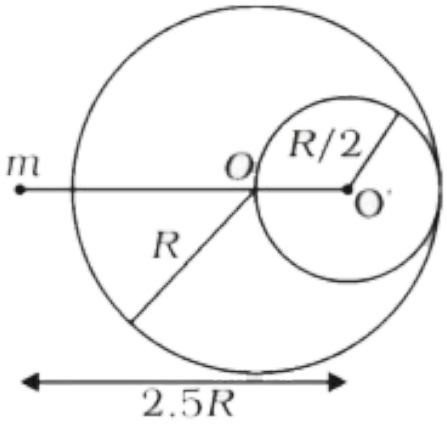
43. A solid sphere of radius R/2 is cut out of a solid sphere of radius R such that the spherical cavity so formed touches the surface on one side and the centre of the sphere on the other side, as shown. The initial mass of the solid sphere was M. If a particle of mass m is placed at a distance 2.5R from the centre of the cavity, then what is the gravitational attraction on the

mass m?



A. Only A is correct

B. Only B is correct

C. Both A, B are false

D. Both A, B are true

Answer: D

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44. Select wrong statement.

A. Radiation has dual nature

B. Radiation some times behaves as wave and at some other times as a particle

C. Radiation exhibit its particle and wave nature simultaneously

D. Radiation cannot exhibit its particle and wave nature simultaneously

Answer: C

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45. A stone is projectef from level ground such that its horizontal and vertical components of initial velocity are $u_x = 10\frac{m}{s}$ and $u_y = 20\frac{m}{s}$ respectively. Then the angle between velocity vector of stone one second before and one second after it attains maximum height is:

A. Evidence of de Broglie.s waves associated with electrons

B. Evidence of particle nature of electrons

C. Evidence of --Ve charge on electrons

D. Evidence of specific charge of electrons

Answer: A

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

A. $\frac{hv}{C}$

B. $\frac{v}{C}$

C. hvC

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

Answer: A

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47. Moseley's law for characteristic X-rays is $\sqrt{v} = a(Z - b)$. In this,

A. Both .a. and .b. are independent of the material

B. a is independent but b depends on the material

C. b is independent but a depends on the material

D. Both a and b depend on the material

Answer: A

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48. In the pure inductive circuit, the curves between frequency f and reciprocal of inductive reactance $1/X_L$ is

A. Straight line

B. Parabola

C. Ellipse

D. Circle

Answer: B

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49. Consider a photon of continuous X-ray and a photon of characteristic X-ray of the same wavelength. Which of the following is/are different for the two photons?

A. frequency

B. energy

C. penetrating power

D. method of creation

Answer: D

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50. When target potential in the X-ray tube is increased

A. frequency of X-rays increases

B. intensity of X-rays remain same

C. penetrating power of X-rays increases

D. All the above

Answer: D

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51. The X-rays beam coming from an X-ray tube will be

A. monochromatic

B. having all wavelengths smaller than a certain maximum wavelength

C. having all the wavelengths larger than a certain minimum wavelength

D. having all wavelengths lying between a minimum and a maximum wave length

Answer: C

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52. Molybdenum is used as a target 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 low thermal conductivity

D. heavy and can easily deflect electrons

Answer: B

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53. Assertio Wavelength of charachteristic X-rays is given by

$$\frac{1}{\lambda} \propto \left(\frac{1}{n_1^2} - \frac{1}{n_2^2} \right)$$

in trasnition from $n_2 \rightarrow n_1$. In the abvoe relation proportionality constant is series dependent. For different series (K-series, L-series, etc.) value of this constant will be different.

Reason For L-series value of this constant is less than the value for K-series

A. Streams of negatively charged particles

B. Streams of protons

C. Stream of electromagnetic radiations

D. Streams of electromagnetic radiations of nuclear origin

Answer: C

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54. Process of biogas production is

A. Photoelectric effect

B. Compton effect

C. Zeeman effect

D. Seeback effect

Answer: A

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55. Penetrating power of X-rays increase with the increase in its

A. intensity

B. amplitude

C. frequency

D. wavelength

Answer: C

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56. Which of the following statement is correct ?

A. Intensity of X-rays depends upon the operating voltage of the tube

B. The upper limit of the frequency of continuous X-rays is zero

C. Penetrating power of X-rays depends on operating voltage of the tube

D. Minimuni wavelength of the X-rays can be decreased by increasing filament current

Answer: C

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57. In a transistor circuit, when the base current is increased by $50\mu A$keeping the collector voltage fixed at 2 V. the collector current increases by 1 mA The current gain of the transistor is

A. intensity of x-rays increases

B. penetrating power of the x-rays remain same

C. wavelength of x-rays in unchanged

D. all the above

Answer: D

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58. Hydrogen atom does not emit X-rays because

A. its energy level are too far apari

B. it has a single electron

C. its energy levels are too close to each other

D. it is too small in size

Answer: C

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59. Which of the following is used to study the structure of crystals ?

A. U.V. rays

B. Infrared

C. X-rays

D. Microwaves

Answer: C

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60. can X-rays be used for photoelectric effect?

A. to detect flaws in casting and welding

B. to detect fractures in bones

C. to study the internal atomic structure of crystal

D. all the above

Answer: D

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61. If the potential difference applied to tube is doubled and the separation between the filament and the target is also doubled, the cutoff wavelength

A. remain unchanged

B. he doubled

C. be halved

D. become four times the original

Answer: C

62. If the current in the circuit for heating the filament is increased, the cutoff wavelength

A. increases

B. decreases

C. remains same

D. may increase or decrease

Answer: C

63. According to moselay.s law, the frequency (ϑ) of the $K\alpha$ line and the atomic number (z) of the element have the relation (A and B) are constants

A. $\frac{\vartheta}{(z-A)} = B$

B. $\frac{\sqrt{\vartheta}}{(z-A)} = B$

C. $\vartheta(Z-A) = B$

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

Answer: B

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64. The second law of thermodynamics states that

A. $\sqrt{v} = a(z - b)$

B. $v = a^2(z - b)$

C. $v = \sqrt{a(z - b)}$

D. $\sqrt{v} = a(z - b)^2$

Answer: A

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

A. Atomic number of element

B. Square of atomic number of element

C. Square root of atomic number of element

D. Fourth power of atomic number of element

Answer: B

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Exercise I Assertion And Reason

1. STATEMENT.1 Photo-omission from a photosensitive surface is possible only if the incident radiation has a frequency above threshold frequency. STATEMENT-2: Unless, the energy of incident photo is greater than the

work function of photo- sensitive surface, no photoemission is possible.

A. A and R are true and R is the correct explanation of A.

B. A and R are true and R is not the correct explanation of A.

C. A is true, R is false.

D. A is false, R is true.

Answer: A

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2. Assertion : The threshold frequency of photoelectric effect supports the particle nature of light.

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

A. A and R are true and R is the correct explanation of A.

B. A and R are true and R is not the correct explanation of A.

C. A is true, R is false.

D. A is false, R is true.

Answer: B

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3. Find out the number of phenotypes in F_2 generation if a character is controlled by 3 pair of polygenes

A. A and R are true and R is the correct explanation of A.

B. A and R are true and R is not the correct explanation of A.

C. A is true, R is false.

D. A is false, R is true.

Answer: A

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4. This question has statement 1 and statement 2. Of the four choices given after the statements, choose the one that best describes the two statements

Statement 1: Davisson - germer experiment established the wave nature of electrons.

Statement 2: If electrons have waves nature, they can interfere and show diffraction.

A. A and R are true and R is the correct explanation of A.

B. A and R are true and R is not the correct explanation of A.

C. A is true, R is false.

D. A is false, R is true.

Answer: C

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Exercise Ii

1. A 100 W sodium lamp radiates energy uniformly in all directions. The lamp is located at the centre of a large sphere that absorbs all the sodium light which is

incident on it. The wavelength of the sodium light is 589 nm. The number of photons delivered per second to the sphere is

A. 3×10^{20} Photons/Sec

B. 5×10^{20} Photons/Sec

C. 7×10^{20} Photons/Sec

D. 9×10^{20} Photons/Sec

Answer: A

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2. The number of photons emitted per second by a 60 W source of monochromatic light of wavelength 663 nm is:

$\left(h = 6.63 \times 10^{-34} Js\right)$

A. 2.51×10^{31}

B. 1.51×10^{31}

C. 7.51×10^{31}

D. 9.51×10^{31}

Answer: A

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3. A laser used to weld detached retinas emits light with a wavelength of 652 nm in pulses that are 20.0ms in duration. The average power during each pulse is 0.6 W. then,

A. $7.5 \times 10^{15} eV, 2.7eV$

B. $6.5 \times 10^{16} eV, 2.9eV$

C. $6.5 \times 10^{16} eV, 2.7eV$

D. $7.5 \times 10^{16} eV, 1.9eV$

Answer: D

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4. The work function for a metal is 4 eV. To eject the photo electrons with zero velocity the wavelength of the incident light should be

A. 2700Å

B. 1700Å

C. 5900Å

D. $3100^{\circ} A$

Answer: D

Watch Video Solution

5. A If the wavelength of the incident radiation changes from λ_1 to λ_2 then the maximum kinetic energy of the emitted photo electrons changes from K to K„ then the work function of the emitter surface is

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

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

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

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

Answer: A

Watch Video Solution

6. A monochromatic source emitting light of wavelength 600 nm has a power output of 66 W. Calculate the number of photons emitted by this source in 2 minutes.

A. 2×10^{16}

B. 2×10^{18}

C. 2×10^{20}

D. 2×10^{22}

Answer: C

Watch Video Solution

7. The threshold wavelength for photoelectric emission from a material is 5200 Å. Photoelectrons will be monochromatic radiation from a

A. 50 watt infrared lamp

B. 1 watt infrared lamp

C. 1 watt ultraviolet lamp

D. 50 watt sodium vapour lamp

Answer: C

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8. The mode of arrangement of sepals or petals in floral bud with respect to the other members of the same whorl is known as

A. 5

B. 3.5

C. 1.5

D. 8.5

Answer: C

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9. 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. 0.58 eV

B. 2.48 eV

C. 1.24 eV

D. 1.16 eV

Answer: A

Watch Video Solution

10. In china rose the flowers are:

A. $3:4:5$

B. $1:3:5$

C. $1:1:1$

D. $5:3:1$

Answer: C

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11. The ratio of distance of two satellites from the centre of earth is 1 : 4. The ratio of their time periods of rotation will be :

A. $1:1$

B. $1:2$

C. $1:3$

D. $1:4$

Answer: B

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12. Sodium and copper have work functions 2.3 eV and 4.5 eV respectively. Then the ratio of the threshold wavelengths is nearest to

A. $1:2$

B. $4:1$

C. $2:1$

D. $1:4$

Answer: C

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13. A proton is moving along the negative direction of X-axis in a magnetic field directed along the positive direction of Y-axis. The proton will be deflected along the negative direction of

A. 7 eV

B. 3 eV

C. 1.5 eV

D. 6 eV

Answer: B

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14. A photo cell is illuminated by a small bright source placed 1m away When the same source of light is placed 2m away, the electrons emitted by photo cathode

A. Each carry one quarter of their previous energy

B. Each carry one quarter of their previous momenta

C. Are half as numerous

D. Four time as numerous

Answer: D

 Watch Video Solution

15. A photon incident on a metal of photo electric work function 2 ev produced photo electron of maximum kinetic energy 2 ev. The wave length associated with the photon is

A. $6200A^{\circ}$

B. $3100A^{\circ}$

C. $9300A^{\circ}$

D. $2000A^{\circ}$

Answer: B

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16. For a certain metal $v = 2_0$ and the electrons come out with a maximum velocity of $4 \times 10^6 \ \mathrm{m\,s^{-1}}$. If the Value of $v = 5v_0$, then maximum velocity of photoelectrons will be (v_0 is the threshold frequency)

A. 8×10^6 m/s

B. 16×10^6 m/s

C. 2×10^6 m/s

D. 12×10^6 m/s

Answer: A

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17. In a photoelectric cell, current stops when a negative potential of 0.5v is given to the collector w.r.t. emitter. The maximum K.E. of emitted electron is

A. 0.8×10^{-19} joule

B. 0.8×10^{-19} erg

C. 0.5 joule

D. 0.5 erg

Answer: A

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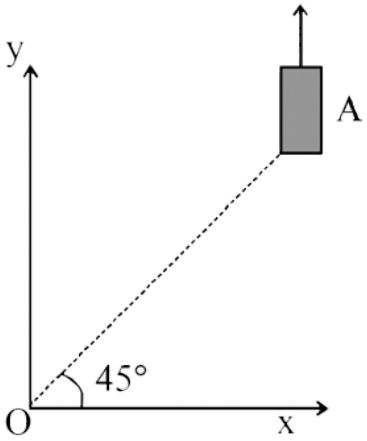
18. On a frictionless horizontal surface , assumed to be the $x-y$ plane , a small trolley A is moving along a straight line parallel to the $y-$ axis (see figure) with a constant velocity of $\left(\sqrt{3}-1\right)m/s$. At a particular instant , when the line OA makes an angle of $45(\circ)$ with the $x-$ axis , a ball is thrown along the surface from the origin O. Its velocity makes an angle ϕ with the $x-$ axis and it hits the trolley .

(a) The motion of the ball is observed from the frame of

the trolley . Calculate the angle θ made by the velocity vector of the ball with the $x-$ axis in this frame .

(b) Find the speed of the ball with respect to the surface , if $\phi = (4\theta)/(3)$.



A. 2V

B. 3.2 V

C. 6.4V

D. 1.6V

Answer: A

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19. Work function of a metal is 3.0 eV. It is illuminated by a light of wavelength 3×10^{-7} m. Calculate the maximum energy of the electron.

A. 0.75V

B. 1.75 V

C. 2.5 V

D. 3.75 V

Answer: B

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20. Photoelectric emission is observed from a metallic surface for frequencies n_1 and n_2 of the incident light rays $(n_1 > n_2)$. 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. $\frac{v_2 - v_1}{K - 1}$

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

A. 2λ

B. 4λ

C. 6λ

D. 8λ

Answer: B

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22. If K_1 and K_2 are maximum kinetic energies of photoelectrons emitted when lights of wavelenth λ_1 and λ_2 respectively incident on a metallic surface.

A. $K_1 > \frac{K_2}{3}$

B. $K_1 < \frac{K_2}{3}$

C. $K_1 > 3K_2$

D. $K_2 = 3K_1$

Answer: B

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23. Light of frequency 1.5 times the threshold frequency is incident on a photosensitive material, photo electric current is emitted. If the frequency of light is halved and intensity is doubled, the photoelectric current becomes

A. 4 times the original current

B. 2 times the original current

C. half the original current

D. zero

Answer: D

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24. The maximum wavelength of a beam of light can be used to produce photo electric effect on a metal is 250 nm. The energy of the electrons in Joule emitted from the surface of the metal when a beam of light of wavelength 200 nm is used $[h = 6.62 \times 10^{-34} Js, C = 3 \times 10^{8} ms^{-1}]$

A. 89.61×10^{-22}

B. 69.81×10^{-22}

C. 18.96×10^{-20}

D. 19.86×10^{-20}

Answer: D

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

A. 1.1 eV

B. 9.5 eV

C. 5.3 eV

D. 4.2 eV

Answer: B

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26. The energy flux of sunlight reaching the surface of the earth is $1.388 \times 10^3 W/m^2$. How many photons (nearly) per square metre are incident on the Earth per second? Assume that the photons in the sunlight have an average wavelength of 550 nm.

A. 2.51×10^{31}

B. 3.84×10^{31}

C. 1.51×10^{31}

D. 7.51×10^{31}

Answer: B

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27. The threshold frequency for a certain metal is v_0. When a certain radiation of frequency $2v_0$ is incident on this metal surface the maximum velocity of the photoelectrons emitted is $2 \times 10^6 ms^{-1}$. If a radiation of frequency $3v_0$, is incident on the same metal surface the maximum velocity of the photoelectrons emitted (in $m.\ s^{-1}$) is

A. 2×10^6

B. $2\sqrt{2} \times 10^6$

C. $4\sqrt{2} \times 10^6$

D. $4\sqrt{3} \times 10^6$

Answer: B

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28. The work function of a certain metal is $3.31 \times 10^{-19} j$then, the maximum kinetic energy of photoelectrons emitted by incident radiation of wavelength $5000Å$ IS(GIVEN,h= $6.62XX10^{-34} J_{-s}, c = 3 \times 10^8 ms^{-1}, e = 1.6 \times 10^{-19} C$)

A. 2.48 eV

B. 0.41 eV

C. 2.07 eV

D. 0.82 eV

Answer: B

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29. A photon of energy E ejects a photoelectron from a metal surface whose work function is ϕ_0. If this electron enters into a uniform magnetic field B in a direction perpendicular to the field and describes a circula path of radius of radius r, then the radius r is (in the usual notation)

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

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

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

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

Answer: D

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30. The surface of a metal is illuminated with the light of 400nm. The kinetic energy of the ejected photoelectrons was found to be $1.68eV$. The work function of the metal is $(hc = 1240eVnm)$

A. 1.41 eV

B. 1.51 eV

C. 1.68 eV

D. 3.09 eV

Answer: A

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31. The ratio of velocities of a proton and an α particle is 4 : 1. The ratio of their De Broglie wave lengths will be

A. $4:1$

B. $1:4$

C. $1:2$

D. $1:1$

Answer: D

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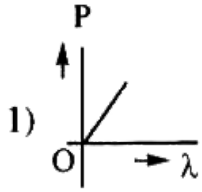
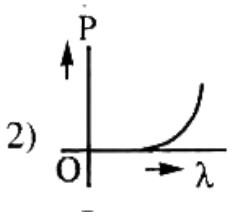
32. Which of the following figure represents the variation of particle momentum (p) and associated de Broglie wavelength (λ)

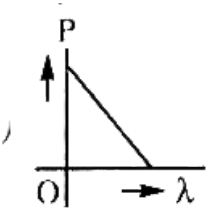
A.



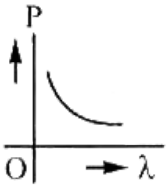
B. 2)



C.



D.



Answer: D

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33. If $\vec{a}$ and $\vec{b}$ are two unit vectors and θ is the angle between them, then the unit vector along the angular bisector of $\vec{a}$ and $\vec{b}$ will be given by

A. $1.2A^\circ$

B. $10A^\circ$

C. $100A^\circ$

D. $1A^\circ$

Answer: A

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34. If the kinetic energy of a particle is increased by 16 times, the percentage change in the de Broglie wavelength of the particle is

A. 1

B. 0.5

C. 0.41

D. 0.73

Answer: B

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35. Find the ratio of de Broglie wavelengths of proton and α-particle of same energy

A. $\sqrt{3}:1$

B. $1:\sqrt{3}$

C. $2:\sqrt{3}$

D. $\sqrt{3}:2$

Answer: A

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36. A positron and a proton are accelerated by the same accelerating potential. Then the ratio of the

associated wavelengths of the positron and the proton will be [M=Mass of proton, m=Mass of positron]

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

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

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

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

Answer: B

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37. The cut-off wavelength of an X-ray depends on

A. $0.248A^{\circ}$

B. $0.496A^{\circ}$

C. $0.124A^{\circ}$

D. $4.96A^{\circ}$

Answer: B

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38. The wavelength of x-rays is of the order of

A. 10^{-4} m

B. 10^{-6} m

C. 10^{-8} m

D. 10^{-10} m

Answer: D

Watch Video Solution

39. The energy of an x-ray photon is 4 kev. Its frequency is nearly

A. 10^{18} Hz

B. 10^{19} Hz

C. 10^{17} Hz

D. 10^{10} Hz

Answer: A

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40. The momentum of a photon of energy $1MeV \text{in} kgm/s$, will be

A. 10^{-22} kg-m/s

B. 5×10^{-22} kg-m/s

C. 3×10^{-6} kg-m/s

D. 0

Answer: B

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41. If λ_{K_α}, λ_{K_β} and λ_{L_α} are the wavelengths of K_α, K_β and L_α lines, then

A. $\lambda_{K_\beta} = \dfrac{\lambda_{K_\alpha}\lambda_{L_\alpha}}{\lambda_{K_\alpha} + \lambda_{L_\alpha}}$

B. $\lambda_{L_\alpha} = \dfrac{\lambda_{K_\alpha}\lambda_{K_\beta}}{\lambda_{K_\alpha} + \lambda_{K_\beta}}$

C. $\lambda_{L_\alpha} = \dfrac{\lambda_{K_\alpha}\lambda_{K_\beta}}{\lambda_{K_\beta} - \lambda_{K_\alpha}}$

D. $\lambda_{K_\beta} = \dfrac{\lambda_{K_\alpha}\lambda_{L_\alpha}}{\lambda_{K_\alpha} - \lambda_{L_\alpha}}$

Answer: A

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42. Atomic numbers of two element are 31 and 41. Find the ratio of the wavelength of the K_α are

A. $4:3$

B. $9:16$

C. $16:27$

D. $16:9$

Answer: D

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Practice Exercisex

1. Two separate monochromatic light beams A and B of the same intensity (energy per unit ara per unit time) are falling normally on a unit area of a metallic

respectively.Their wavelength are λ_A and λ_B respectively. Assuming that all the incident light is used in ejecting the photoelectrons form beam A and that from B is

A. $(\lambda_A / \lambda_B)^2$

B. $(\lambda_B / \lambda_A)^2$

C. (λ_A / λ_B)

D. $(\lambda_B / \lambda_A)1$

Answer: C

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2. The maximum kinetic energy of an electron is E when the incident wavelength is λ To increase the maximum kinetic energy of the electron to 2E the incident wavelength must be :

A. 2λ

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

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

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

Answer: C

Watch Video Solution

3. Two sources A and B have same power . The wavelength of radiation of A is λ_a and that of B is λ_b .The number of photons emitted per second by A and B are n_a and n_b respectively, then

A. $\lambda_a > \lambda_b$

B. if $\lambda_a > \lambda_b, n_a < n_b$

C. if $\lambda_a < \lambda_b, n_a < n_b$

D. if $\lambda_a > \lambda_b, n_a = n_b$

Answer: C

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4. The photo electric threshold wavelength for a metal is $2750A^{\circ}$, The minimum energy of a photon that can produce photoelectric effect in the metal is

A. 0.045eV

B. 0.45 eV

C. 4.5 eV

D. 0.0045 eV

Answer: C

Watch Video Solution

5. When the incident wavelengths are λ and $\lambda/2$ the kinetic energies of the emitted photo electrons are E and 2E. The work function of the metal is

A. E/4

B. E/2

C. E/3

D. Zero

Answer: D

Watch Video Solution

6. A 1 kw radio transmitter operates at a frequency of 880 KHz how many photons per second does it emit ?

A. 1.7×10^{28}

B. 1.7×10^{30}

C. 1.7×10^{23}

D. 17×10^{25}

Answer: B

Watch Video Solution

7. The threshold wavelength for photo electric emission from a material is $5000A^0$. Photo electrons will be

emitted when the material is illuminated with monochromatic radiation from

A. 100 watt infrared lamp

B. 1 watt infrared lamp

C. 50 watt sodium vapour lamp

D. 50 watt ultra violet lamp

Answer: D

Watch Video Solution

8. Light of wavelength 4000A∘ is incident on a metal surface. The maximum kinetic energy of emitted

photoelectron is 2 eV. What is the work function of the metal surface?

A. 1 eV

B. 2.1 V

C. 4000 V

D. 3.1 V

Answer: A

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9. Monochromatic light incident on a metal surface emits electrons with kinetic energies from zero to 2.6

eV. What is the least energy of the incident photon if the tightly bound electron needs 4.2eV to remove?

A. 4.2 eV

B. 1.6 eV

C. 6.8 eV

D. 7.0 eV

Answer: C

Watch Video Solution

10. Three metals have work functions in the ratio 2 3:4. Graphs are drawn for all connecting stopping potential

and incident frequency. The graphs have slopes in the ratio

A. $2:3:4$

B. $4:3:2$

C. $6:4:3$

D. $1:1:1$

Answer: D

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11. Two photons of energies twice and thrice the work function of a metal are incident on the metal surface

.Then, the ratio of maximum velocities of the photoelectrons emitted in the two cases respectively ,is

A. $\sqrt{2}:1$

B. $\sqrt{3}:3$

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

D. $1:\sqrt{2}$

Answer: D

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12. The work function of substance is 4.0 eV. The longest wavelength of light that can cause

photoelectron emission from this substance is approximately

A. 310 nm

B. 400 nm

C. 540 nm

D. 220 nm

Answer: A

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13. Photoelectric work function of a metal is $1eV$, light of wavelength $\lambda = 3000\text{Å}$ falls on it. The

photoelectrons come out with velocity.

A. 10 m/s

B. 10^3 m/s

C. 10^4 m/s

D. 10^6 m/s

Answer: D

Watch Video Solution

14. 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 0.6 V

B. the saturation current will be 2 mA

C. neither 1 nor 2

D. both 1 and 2

Answer: D

Watch Video Solution

15. The work function of a substance is 12.4 eV. The longest wavelength of light that can cause photoelectron emission from this substance is approximately

A. 540 nm

B. 400 nm

C. 310 nm

D. 100 nm

Answer: D

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16. A surface irradiated with light of wavelength 480 nm gives out electrons with maximum velocity vms^{-1}, the cut off wavelength being 600 nm. The same surface would release electrons with maximum velocity $2vms^{-1}$ if it is irradiated by light of wavelength

A. 320 nm

B. 200 nm

C. 300 nm

D. 150 nm

Answer: C

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17. What P.D. must be applied to stop the fastest photo electron emitted by a nickel surface when illuminated by ultraviolet light of wave length $2000^{\circ} A$. The work function of nickel is 5 eV

A. 5 V

B. 6.2 V

C. 1.2 V

D. 1.2 V

Answer: C

Watch Video Solution

18. The threshold frequency for photo electric effect for a metal surface is found to be 4.8×10^{16} Hz. The stopping potential required when the metal is irradiated by radiation of frequency 5.6×10^{16} Hz is (taking $h = 6.6 \times 10^{-34} Js$ and $c = 1.6 \times 10^{-19} C$)

A. 22.4 V

B. 33 V

C. 66 V

D. 198 V

Answer: B

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19. 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 surface of A and B respectively, the ratio of the maximum kinetic energies of photoelectrons emitted is (f is greater than thershold 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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20. When a metal surface is illuminated by light of wavelengths 400 nm and 250 nm, the maximum velocities of the photoelectrons ejected are v and 2v respectively. The work function of the metal is (h=Planck's constant,c=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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21. V_1 and V_2 are the stopping potentials for the incident radiations of wave lengths λ_1 and λ_2 respectively are incident on a metallic surface. If $\lambda_1 = 3\lambda_2$ then

A. $V_1 > 3V_2$

B. $V_2 > 3V_1$

C. $V_1 > \frac{V_2}{3}$

D. $V_1 < \frac{V_2}{3}$

Answer: D

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22. A monochromatic source of lightis placed at a large distance d From a metal surface. Photoelectrons are ejected at rate n, the kinetic energy being E. If the source is brought nearer to distance $\frac{d}{2}$, the rate and kinetic energy per photoelectron become nearly

A. 2n and 2E

B. 4n and 4E

C. 4n and E

D. n and 4E

Answer: C

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23. If the work function for a certain metal is 3.2×10^{-19} J and it is illuminated with light of frequency $v = 8 \times 10^{14}$ Hz, the maximum kinetic energy of the photoelectron would be

A. $2.1 \times 10^{-19} J$

B. $8.5 \times 10^{-19} J$

C. $5.3 \times 10^{-19} J$

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

Answer: A

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24. Work function of a metal is 3.0 eV. It is illuminated by a light of wavelength 3×10^{-7} m. Calculate the maximum energy of the electron.

A. 4.14 eV

B. 2.14 eV

C. 3.16 eV

D. 1.16 eV

Answer: D

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25. A metal sheet of silver is exposed to ultraviolet radiation of wavelength $1810A^0$. The threshold wavelength of silver is $2640A^0$ Calculate the maximum energy of emitted electron.

A. 3.15 eV

B. 4.15 eV

C. 5.15 eV

D. 2.15 eV

Answer: D

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26. The threshold wavelength for emission of photoelectrons from a metal surface is 6×10^{-7} m. What is the work function of the material of the metal surface ?

A. $6.66 \times 10^{-19} J$

B. $4.44 \times 10^{-19} J$

C. $3.33 \times 10^{-19} J$

D. $5.55 \times 10^{-19} J$

Answer: C

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27. What will be the minimum frequency of light source to get photocurrent, from a metal surface having work function 2 eV ?

A. $4.8 \times 10^{14} Hz$

B. $5.8 \times 10^{14} Hz$

C. $7.8 \times 10^{14} Hz$

D. $2.8 \times 10^{14} Hz$

Answer: A

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28. A stationary shell of mass M explodes in to two parts and their masses are in the ratio 2:3, then the ratio of their deBroglie wavelengths is

A. $2:3$

B. $3:2$

C. $9:4$

D. $1:1$

Answer: D

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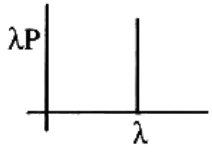
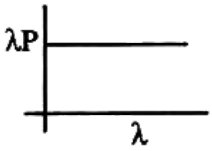
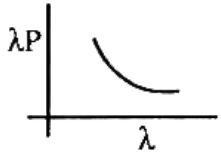
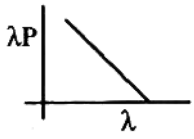
29. The graph between deBroglie wavelength (λ) and (λp) is (p is the linear momentum of the particle)

A. 

B. 

C. 

D. 

Answer: B

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30. The de Broglie wavelength of an electron is $1A^{\circ}$. In what potential difference electron accelerates

A. 100 V

B. 150

C. 225 V

D. 256 V

Answer: B

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31. If the velocity of the particle reduced to one third, then the percentage increase in its deBroglie wavelength is

A. 1

B. 2

C. 3

D. 4

Answer: B

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32. The ratio of the deBroglie wavelengths of proton, deuteron and alpha particle accelerated through the same potential difference 100V is

A. $2:2:1$

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

C. $2:1:2$

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

Answer: D

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33. Find the momentum of an electron having wavelength $2A^0 \left(h = 6.62 \times 10^{-34} Js\right)$

A. $1 \times 10^{-24} kgms^{-1}$

B. $3.3 \times 10^{-24} kgms^{-1}$

C. $4 \times 10^{-23} kgms^{-1}$

D. $6 \times 10^{-24} kgms^{-1}$

Answer: B

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34. Calculate the wavelength (in nanometer) associated with a proton moving at $1.0 \times 10^3 ms^{-1}$ (Mass of

proton $= 1.67 \times 10^{-27} kg$ and $h = 6.63 \times 10^{-34} Js$)

A. $2.28 \times 10^{-12} m$

B. $1.28 \times 10^{-10} m$

C. $1.28 \times 10^{-12} m$

D. $2.28 \times 10^{-10} m$

Answer: C

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35.

- $5.8 \times 10^{-16} N$
- $2.4 \times 10^{-16} N$
- $9.6 \times 10^{-16} N$
- $4.8 \times 10^{-16} N$

Answer: D

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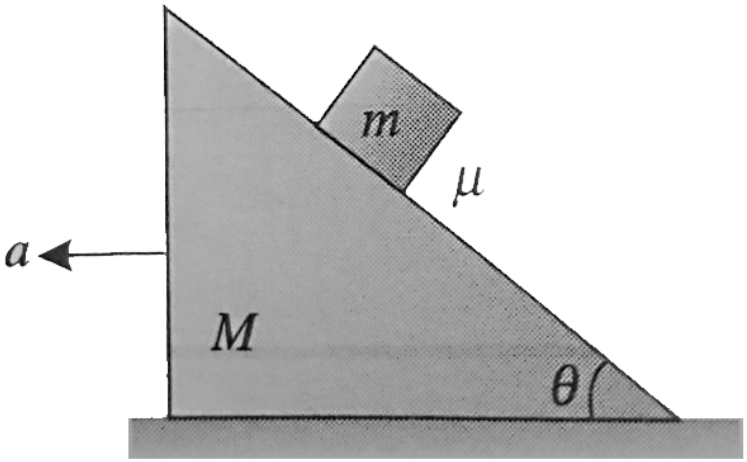

36.

A block of mass m is at rest relative to the stationary wedge of mass M. The coefficient of friction between block and wedge is μ. The wedge is now pulled horizontally with acceleration a as shown in figure.

Then the minimum magnitude of a for the friction between block and wedge to be zero is:

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

B. $\frac{hC}{Ve}$

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

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

Answer: A

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37. STATEMENT -1 : Work function of a metal depends on ionisation energy.

STATEMENT-2 : One photon can eject one electron

STATEMENT -3 : K.E. of ejected depends on intensity of light

A. 12 keV

B. 7 eV

C. 7 MeV

D. 10 BeV

Answer: A

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38. With a d.c power supply giving 10mA at a p.d of 50 kV. The power of the emitted x-ray is 5 watt. The efficiency of the x-ray tube is

A. 0.1

B. 0.01

C. 0.05

D. 0.25

Answer: B

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39. Iron (z = 26) emits k_α line of wavelength $1.96A^\circ$. For an element of unknown atomic number the wavelength of k_α line is $0.49A^0$ The atomic number of the unknown element is

A. 51

B. 49

C. 196

D. 31

Answer: A

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40. Obtain a relation between the frequencies of K_α, K_β and L_α line for a target metrial .

A. $v_{K_\alpha} + v_{K_\beta} = v_{L_\alpha}$

B. $v_{K_\alpha} - v_{K_\beta} = v_{L_\alpha}$

C. $v_{K_\alpha} + v_{L_\alpha} = v_{K_\beta}$

D. $v_{K_\alpha} - v_{L_\alpha} = v_{K_\beta}$

Answer: C

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41. The energy of a photon is equal to the kinetic energy of a

proton. The energy of the photon is E. Let λ_1 be the de-Broglie wavelength of the

proton and λ_2 be the wavelength of the photon. The ratio $\frac{\lambda_1}{\lambda_2}$ is proportional to

(a) E^0 (b) $E^{1/2}$ (c) E^{-1} (d) E^{-2}

A. E^4

B. $E^{1/2}$

C. E^1

D. E^2

Answer: B

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42. The radiation corresponding to $3 \rightarrow 2$ transition of hydrogen atom falls on a metal surface to produce photoelectrons. These electrons are made to enter a magnetic field of $3 \times 10^{-4} T$. If the radius of the largest circular path followed by these electrons is 10.0 mm, the work function of the metal is close to :

A. 1.6 eV

B. 1.8 eV

C. 1.1 eV

D. 0. 8 eV

Answer: C

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