RAVI MATHS TUITION CENTER , CHENNAI- 82. WHATSAPP - 8056206308

Dual Nature Of Radiation And Matter MCQ TEST

12th Standard

Physics

138 x 1 = 138

1) The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1 MeV energy is nearly

(a) 1.2 nm (b) $1.2x10^{-3}$nm (c) $1.2x10^{-6}$nm (d) $1.2x10^{1}$nm

2) Consider a beam of electrons (each electron with energy E_0) incident on metal surface kept in an evacuated chamber.Then

(a) no electrons will be emitted as only photons can emit electrons.

(b) electrons can be emitted but all with an energy, E_0.

(c) electrons can be emitted with any energy,with a maximum of $E_0 - -\phi$($\phi$is the work function).

(d) electrons can be emitted with any energy, with a maximum of E_0

3) A proton,a neutron, an electron and an α-particle have the same energy.Then their de-Broglie wavelengths compare as

(a) $\lambda_p = \lambda_n > \lambda_c > \lambda_\alpha$ (b) $\lambda_\alpha < \lambda_= \lambda_n > \lambda_c$ (c) $\lambda_e < \lambda_= \lambda_n > \lambda_\alpha$ (d) $\lambda_c = \lambda = \lambda_n = \lambda_\alpha$

4) An electron is moving with an initial velocity $\frac{h}{mv} = v_0 \hat{L}$ and is in a magnetic field $\overrightarrow{B} = B_0 \vec{j}$ Then its de-Broglie wavelength

(a) remains constant (b) increases with time. (c) decreases with time.

(d) increases and decreases periodically.

5) An electron (mass m) with an initial velocity $v = v_0 \vec{i} (v_0 > 0)$ is an electric field $v = v_0 \vec{i} (v_0 > 0)$ its de-Broglie wave-length at time t is given by

(a) $\frac{\lambda_0}{\left(1 + \frac{eE_0}{m} \frac{t}{v_0}\right)}$ (b) $\lambda \left(1 + \frac{eE_0 t}{mv_0}\right)$ (c) λ_0 (d) $\lambda_0 t$.

6) An electron (mass m) with an initial velocity $v = v_0 \vec{i}$ is in an electric field $E = E_0 \vec{j} E = E_0 \vec{j}$. If $\lambda = \frac{h}{mv_0}$ its de-Broglie wavelength at time t is given by

(a) λ_0 (b) $\lambda_0 \sqrt{1 + \frac{e^2 E_0^2 \quad t^2}{m^2 v_0^2}}$ (c) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E^2 t^2}{m^2 v_0^2}}}$ (d) $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E^2 t^2}{m^2 v_0^2}}}$

7) Relativistic corrections become necessary when the expression for the kinetic energy $\frac{1}{2} mv^2$ becomes comparable with mc^2 where m is the mass of the particle.At what de-Broglie wavelength will relativistic corrections become important for an electron?

(a) $\lambda = 10nm$ (b) $\lambda = 10^{-1} nm$ (c) $\lambda = 10^{-4} nm$ (d) $\lambda = 10^{-6} nm$

8) Two particles $A_1 and A_2$ of masses $m_1, m_2 (m_1 > m_2)$ have the same de-Broglie wavelength.Then

(a) their momenta are the same. (b) their energies are the same.

(c) energy of A_1 is less than the energy of A_2. (d) energy of $A_1$is more than the energy of A_2 .

9) The de-Broglie wavelength of a photon is twice the de-Broglie wavelength of an electron.The speed of the electron is $v_e = \frac{c}{100}$ Then

(a) $\frac{E_e}{E_p} = 10^{-4}$ (b) $\frac{E_e}{E_p} = 10^{-2}$ (c) $\frac{p_e}{m_e c} = 10^{-2}$ (d) $\frac{p_e}{m_e c} = 10^{-4}$

10) Photons absorbed in matter are converted to heat.A source emitting n photon/sec frequency v is used to convert 1 kg of ice at $0^0 c$. Then the time t taken for the conversation.

(a) decreases with increasing n, with v fixed. (b) decreases with n fixed, v increasing

(c) remains constant with n and v changing such that nv = constant

(d) increases when the product nv increases.

11) The photoelectric effect can be explained on the basis of

(a) Corpuscular theory (b) Wave theory (c) Electromagnetic theory (d) quantum theory

12) Which of the following has minimum stopping potential?

(a) Blue (b) Yellow (c) Violet (d) Red

13) When radiation is incident on a photoelectron emitter, the stopping potential is found to be 9V.If e/m for the electron is $1.8 \times 10^{11} C/kg$ .the maximum velocity of the ejected electron is

(a) $6 \times 10^5 m/s$ (b) $8 \times 10^5 m/s$ (c) $10^6 ms^{-1}$ (d) $1.8 \times 10^6 m/s$

14) Two photons, each of energy 2.5eV are simultaneously incident on the metal surface.If the work function of the metal is 4.5eV, then from the surface of metal

(a) one electron will be emitted with energy 0.5eV (b) two electrons will be emitted with energy 0.25eV

(c) more than two electrons will be emitted (d) not a single electron will be emitted.

15) The maximum velocity of an electron emitted by light of wavelength λincident on the surface of a metal of wor4k function ϕ is[h =Plank's constant,c= speed of light and m=mass of electron]

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

16) The photoelectric work function for a metal surface is 4.125eV.The cutoff wavelength for this surface is

(a) $4125\mathring{A}$ (b) $2062.5\mathring{A}$ (c) $3000\mathring{A}$ (d) $6000\mathring{A}$

17) The slope of frequency of incident light and stopping potential for a given surface will be

(a) h (b) h/e (c) eh (d) e

18) The threshold wavelength for a metal having work function ϕ_0 is λ_0.What is the threshold wavelength for a metal whose work function is $\phi_0/2$

(a) $4\lambda_0$ (b) $2\lambda_0$ (c) $\lambda_0/2$ (d) $\lambda_0/4$

19) The work function for metals A,B and C are respectively 1.92eV, 2.0eV and 5.0eV.According to Einstein's equation, the metals which will emit photoelectrons for radiation of wavelength $4100\mathring{A}$ is/are

(a) none (b) A only (c) A and B only (d) B and C only

20) The wavelength of matter wave is independent of

(a) mass (b) velocity (c) momentum (d) charge

21) If E1, E_2, E_3 and E_4 are the respective kinetic energies of electron, deutron, proton and neutron having same de-Broglie wavelength.Select the correct order in which those values would increase.

(a) E_1,E_3,E_4,E_2 (b) E_2,E_4,E_3,E_1 (c) E_2,E_4,E_1,E_3 (d) E_3,E_1,E_2,E_4

22) What is de-Broglie wavelength associated with electron moving under a potential difference of 10^4 V.

(a) 12.27nm (b) 1 nm (c) 0.01227nm (d) 0.1227nm

23) A particle is dropped from a height H.The de Broglie wavelength of the particle as a function of height is proportional to

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

24) The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1 MeV energy is nearly,

(a) $1.2nm$ (b) $1.2 \times 10^{-3} nm$ (c) $1.2 \times 10^{-6} nm$ (d) $1.2 \times 10^1 nm$

25) Consider a beam of electrons (each with energy E_0)incident on a metal surface kept in an evacuated chamber.Then

(a) no electrons will be emitted as only photons can emit electrons

(b) electrons can be emitted but all with an energy E_0

(c) electrons can be emitted with any energy, with a maximum of $E_0 - \phi$($\phi$is the work function)

(d) electrons can be emitted with any energy, with a maximum of E_0

26) An electron is moving with an initial velocity $\vec{v} = v_0\,\hat{i}$ and is in a magnetic field $\vec{B} = B_0\,\hat{j}$ .Then it's de Broglie wavelength

(a) remains constant (b) increases with time (c) decreases with time

(d) increases and decreases periodically

27) Two particles A_1 and A_2 masses m_1,m_2 (m_1 > m_2) have the same de Broglie wavelength.Then

(a) their momenta are their same (b) their energies are their same

(c) energy of A_1 is less than the energy of A_2 (d) energy of A_1 is more than the energy of A_2

28) When a metallic 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 V/4.The threshold wavelength for the metallic surface is

(a) 4λ (b) 5λ (c) $5\lambda/2$ (d) 3λ

29) A photoelectric surface is illuminated successively by monochromatic light of wavelength $\lambda$and $\lambda/2$if the maximum kinetic energy of the emitted photoelectrons in the second case is 3 times that of first case, the work function of the material is (h=plank's constant c=speed of light)

(a) $\frac{hc}{3\lambda}$ (b) $\frac{hc}{2\lambda}$ (c) $\frac{hc}{\lambda}$ (d) $\frac{2hc}{\lambda}$

30) If K_1 and K_2 are maximum kinetic energies of photoelectrons emitted when light of wavelength $\lambda_1$and $\lambda_2$respectively are incident on a metallic surface.If $\lambda_1 = 3\lambda_2$

(a) $K_1 > \left(\frac{K_2}{3}\right)$ (b) $K_1 < \left(\frac{K_2}{3}\right)$ (c) $K_1 = 3K_2$ (d) $K_2 = 3K_1$

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

(a) depends on the nature of the metal used (b) depends on the intensity of the radiation

(c) depends both on the intensity of the radiation and the metal used

(d) is the same for all metals and independent of the radiation.

32) A and B are two metals with threshold frequencies $1.8 \times 10^{14} Hz$and $2.2 \times 10^{14} Hz$Two identical photons of energy 0.825 eV each are incident on them.Then photoelectrons are emitted in (take $h = 6.63 \times 10^{-34} J/s$

(a) B alone (b) A alone (c) neither A nor B (d) both A and B

33) In a photoemissive cell, with exciting wavelength $\lambda$the fastest electron has speed v,.If the exciting wavelength is changed to $\frac{3\lambda}{4}$, the speed of the fastest electron will be

(a) $v\left(\frac{3}{4}\right)^{1/2}$ (b) $v\left(\frac{4}{3}\right)^{1/2}$ (c) $lessthan\ v\left(\frac{3}{4}\right)^{1/2}$ (d) $greaterthan\ v\left(\frac{3}{4}\right)^{1/2}$

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

(a) the stopping potential will decrease (b) the threshold wavelength will increase

(c) the photoelectric current will increase (d) the kinetic energy of the electrons will increase

35) When a metallic surface is illuminated with monochromatic light of wavelength $\lambda$the stopping potential for photoelectric current is $3V_0$.When the same surface is illuminated with the light of wavelength $2\lambda$the stopping potential is V_0.The threshold wavelength of this surface for photoelectric effect is

(a) $4\frac{\lambda}{3}$ (b) 4λ (c) 6λ (d) 8λ

36) The kinetic energy of an electron is E.When the incident light has wavelength λ To increase the kinetic energy to 2E, the incident light must have wavelength.

(a) $\frac{hc}{E\lambda - hc}$ (b) $\frac{h\lambda}{E\lambda + hc}$ (c) $\frac{hc\lambda}{E\lambda + hc}$ (d) $\frac{hc\lambda}{E\lambda - hc}$

37) When light of wavelength 400nm is incident on the cathode of a potential is 6V.If the wavelength of incident light is increased by 600nm, the new value of stopping potential is: [use hc=1240 eVnm]

(a) 4.97V (b) 4.76V (c) 4.56V (d) 4.14V

38) A photosensitive metallic surface has work function hv_0.If photons of energy $3hv_0$ falls on this surface.The electrons come out with a maximum velocity of $5 \times 10^6 m/s$.When the photon energy is increased to $9v_0$.The maximum velocity of photoelectron will be:

(a) $8 \times 10^5 m/s$ (b) $10^9 m/s$ (c) $10^8 m/s$ (d) $10^7 m/s$

39) If the elctron frequency of light in a photoelectric experiment is doubled the stopping potential will

(a) be doubled (b) be halved (c) become more than double (d) become less than double

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

(a) 2 (b) 3 (c) 4 (d) 6

41) The velocity of the most energetic electrons emitted from a metallic surface is doubled when the frequency v of incident radiation is double.The work function of this metal is

(a) zero (b) hv/3 (c) hv/2 (d) 2hv/3

42) Light wavelength λ strikes a photosensitive surface and electrons are ejected with kinetic energy E.If the 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) $\lambda' > \lambda$ (d) $\frac{\lambda}{2} < \lambda' < \lambda$

43) Monochromatic light of frequency f_1 incident on a photocell and the stopping potential is found to be V_1.What is the new stopping potential of the cell if it radiated by monochromatic light of frequency f_2?

(a) $V_1 - \frac{h}{e}(f_2 - f_1)$ (b) $V_1 + \frac{h}{e}(f_2 + f_1)$ (c) $V_1 - \frac{h}{e}(f_2 + f_1)$ (d) $V_1 + \frac{h}{e}(f_2 - f_1)$

44) The threshold frequency for a certain metal is v_0 When light of frequency $2v_0$ is incident on it, the maximum velocity of photoelectrons is $4 \times 10^6 ms^{-1}$.If the frequency of incident radiation is increased by $3v_0$ then the maximum velocity of photoelectrons in ms^{-1}will be

(a) $(4/5) \times 10^6$ (b) 2×10^6 (c) 4×10^6 (d) 8×10^6

45) Silver has a work function of 4.7eV when ultraviolet light of wavelength 100 nm is incident upon it, a potential 0f 7.7 is required to stop the photoelectrons from reaching the collector plate.How much potential will be required to stop the photoelectrons when light of wavelength 200 nm is incident upon silver?

(a) 3.85V (b) 1.93V (c) 1.50V (d) 3.0V

46) In a photoelectric effect experiment, the maximum kinetic energy of the emitted electron is 1 eV for incoming radiation of frequency v_0 and 3 eV for incoming radiation of frequency $3v_0/2$.What is the maximum kinetic energy of electrons emitted fro incoming radiation of frequency $9 v_0/4$?

(a) 3 eV (b) 4.5 eV (c) 6 eV (d) 9 eV

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

(a) infrared region (b) X-ray region (c) ultraviolet region (d) visible region

48) Given that light of wavelength 10,000 $\mathring{A}$has an energy equal to 1.23eV.When light of wavelength 5000 $\mathring{A}$ and intensity I_0 falls on a photosensitive plate of photocell, the saturation current is $0.43 \times 10^{-6} A$ and the stopping potential is 1.36V Then the work function is

(a) 0.43eV (b) 1.10eV (c) 1.36eV (d) 2.72eV

49) When the energy of the incident radiation is increased by 20%, the kinetic energy of the photoelectrons emitted from a metal surface increased from 0.5eV to 0.8eV.Thew work function of the metal is

(a) 0.65eV (b) 1.0eV (c) 1.3eV (d) 1.5eV

50) Light described at a place by the equation$E = (100\ V/m)\ [\sin(6 \times 10^{15} s^{-1})t + \sin(8 \times 10^{15} s^{-1})t]$ falls on a metal surface having work function 2.28eV. The maximum energy of the photoelectrons is: (use h = $6.63 \times 10^{-34} Js$)

(a) 2.28eV (b) 3.0eV (c) 1.24eV (d) 1.50eV

51) The curve drawn between velocity and frequency of a photon in vacuum will be a

(a) straight line parallel to frequency axis (b) straight line parallel to velocity axis

(c) staright line passing through origin and making an angle of 45° with frequency axis (d) hyperbola

52) The momentum of a photon of an electromagnetic radiation is $4.3 \times 10^{-29} kgm/s$what is the frequency of the associated waves?$h = 6.63 \times 10^{-34} Js, c = 3 \times 10^{8} m/s$

(a) $1.5 \times 10^{13} Hz$ (b) $1.95 \times 10^{13} Hz$ (c) $5.6 \times 10^{13} Hz$ (d) $3.9 \times 10^{13} Hz$

53) The wavelength of a KeV photon is $1.24 \times 10^{-9} m$ .What is the frequency of 1 MeV photon?

(a) $1.24 \times 10^{15} Hz$ (b) $2.4 \times 10^{20} Hz$ (c) $1.24 \times 10^{18} Hz$ (d) $2.4 \times 10^{23} Hz$

54) Ultraviolet light of wavelength 300nm and intensity 1.0 watt/m^2 falls on the surface of a photosensitive material.If one percent of the incident photon produce photoelectron then the number of photoelectrons emitted per second from an area 1.0cm^2 of the surface is nearly.$h = 6.6 \times 10^{-34} Js$

(a) 2.13×10^{11} (b) 1.51×10^{12} (c) 4.12×10^{13} (d) 9.61×10^{14}

55) We may state that the energy E of a photon of frequency v is E=hv, where h is Plank's constant.The momentum p of a photon is $p = h/\lambda$.where λ is the wavelength of the photon.From the above statement one may conclude that the wave velocity of light is equal to

(a) $3 \times 10^{8} m/s$ (b) E/p (c) Ep (d) $(E/p)^2$

56) A sodium lamp emits 3.14×10^{20}photons per second.Calculate the distance from sodium lamp where flux of photon is one photon per second per cm^2.

(a) $10^{10} cm$ (b) $5 \times 10^{9} cm$ (c) $5 \times 10^{8} cm$ (d) $10^{9} cm$

57) A 200 W sodium street lamp emits yellow light of wavelength. 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) 5×10^{20} (b) 6×10^{18} (c) 62×10^{20} (d) 3×10^{19}

58) One gram mass falls through a height 2 cm.If whole of the energy fall is converted into light of wavelength $h = 6.63 \times 10^{-7} Js$how many photons would be produced?Given $h = 6.63 \times 10^{-7} Js; g = 10m/s^2$

(a) 3.33×10^{14} (b) 3.33×10^{15} (c) 6.67×10^{14} (d) 6.67×10^{15}

59) A parallel beam of monochromatic light of wavelength 500nm is incident normally on a perfectly absorbing surface.The power through any cross-section of the beam is 10W.The force exerted by the light beam on the surface is: Use hc=1240eV nm.

(a) $1.11 \times 10^{-8} N$ (b) $2.22 \times 10^{-8} N$ (c) $3.33 \times 10^{-8} N$ (d) $6.66 \times 10^{-8} N$

60) A beam of light of wavelength 400nm and power 1.55 mW is directed at the cathode of a photoelectric cell.If only 10% of the incident photons effectively produce photoelectron, then find current due to these electrons.(Given, $hc = 1240eVnm, e = 1.6 \times 10^{-19} C$)

(a) $5\mu A$ (b) $40\mu A$ (c) $50\mu A$ (d) $114\mu A$

61) An X-ray tube operates at 10KV.The ratio of X-ray wavelength to the de-Broglie wavelength is

(a) $10 : 1$ (b) $1 : 10$ (c) $1 : 100$ (d) $100 : 1$

62) An electron accelerated under a potential difference V volt has a certain wavelength.λMass of proton has to have the same wavelength λthen it will have to be accelerated under a potential difference of

(a) $V volt$ (b) $1840 V volt$ (c) $V/1840 volt$ (d) $\sqrt{1840} Volt$

63) If λ_1 *and* λ_2 denote the wavelength of de-Broglie waves for electron in Bohr's First and second orbits in the hydrogen atom, then $\frac{\lambda_1}{\lambda_2}$will be

(a) 2 (b) 1/2 (c) 4 (d) 1/4

64) For Bragg's diffraction by a crystal to occur, then the X-ray of wavelength λ and interatomic distance d must be

(a) $\lambda$is greater than 2d (b) λequals 2d (c) $\lambda$is smaller than or equal to 2d (d) $\lambda$is smaller than 2d

65) The energy that should be added to an electron to reduce its de-Broglie wavelength from 2×10^{-9} to 0.5×10^{-9} will be

(a) 1.1 MeV (b) 0.56MeV (c) 0.56KeV (d) 5.6 eV

66) The kinetic energy of an electron gets quadrupled then the de-Broglie wavelength associated with it changes by the factor.

(a) 1/4 (b) 2 (c) 1/2 (d) 4

67) The ratio between masses of two particles is 1:2 and ratio between their temperatures is also 1:2 The ratio between their de-Broglie wavelength

(a) 1:2 (b) 2:1 (c) 1:3 (d) 3:1

68) The de-Broglie wavelength of the tennis ball of mass 60g moving with a velocity of 10m/s is approximately:(Plank's constant h=$h = 6.63 \times 10^{-34} Js$

(a) $10^{-33} m$ (b) $10^{-31} m$ (c) $10^{-16} m$ (d) $10^{-25} m$

69) The de-Broglie wavelength associated with proton changes by 0.25% if its momentum is changed by p_0.The initial moemntum was

(a) $100p_0$ (b) $p_0/400$ (c) 401 p_0 (d) $p_0/100$

70) 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 a 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

71) The energy of a photon is equal to the K.E. 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}

72) If the kinetic energy of the particle is increased to 16 times, the percentage change in the de-Broglie wavelength of the particle is

(a) 25% (b) 75% (c) 60% (d) 50%

73) The moving proton and αparticle are subjected to the same magnetic field so that the radii of their paths are equal to each other.Assuming the field induction is $\vec{B}$perpendicular to the velocity vector of the α particle and proton, the ratio of de-Broglie wavelength of α particle to that of proton is

(a) 1/4 (b) 1/2 (c) 1 (d) 2

74) The ratio of de-Broglie wavelength of molecules of hydrogen and helium in two gas jars kept separately at temperature of $27^\circ C$and $127^\circ C$

(a) $\frac{2}{\sqrt{3}}$ (b) 2/3 (c) $\frac{\sqrt{3}}{8}$ (d) $\sqrt{\frac{8}{3}}$

75) What is the de-Broglie wavelength of the particle accelerated through a potential difference V?Given, $h = 6.63 \times 10^{-34} Js$mass of a nucleon=$1.66 \times 10^{-27} kg$

(a) $\frac{12.27}{\sqrt{V}} \mathring{A}$ (b) $\frac{0.202}{\sqrt{V}} \mathring{A}$ (c) $\frac{0.101}{\sqrt{V}} \mathring{A}$ (d) $\frac{0.287}{\sqrt{V}} \mathring{A}$

76) The de-Broglie wavelength of electron in ground state of hydrogen atom is:[The radius of the first orbit of hyfrogen atom is 0.53 $\mathring{A}$

(a) $0.52\mathring{A}$ (b) $1.06\mathring{A}$ (c) $1.67\mathring{A}$ (d) $3.33\mathring{A}$

77) A free particle with inintial kinetic energy E, de-Broglie wavelength enters a region where in it has a potential energy V, what is the new de-Broglie wavelength?

(a) $\lambda(1 - V/E)$ (b) $\lambda(1 + V/E)$ (c) $\lambda(1 - V/E)^{1/2}$ (d) $\lambda(1 + V/E)^2$

78) $\lambda_e, \lambda_p$and $\lambda_\alpha$are the de-Broglie wavelengths of electron, proton and α particle.If all are accelerated by potential, then

(a) $\lambda_e, < \lambda_p < \lambda_\alpha$ (b) $\lambda_e, < \lambda_p > \lambda_\alpha$ (c) $\lambda_e, > \lambda_p < \lambda_\alpha$ (d) $\lambda_e, = \lambda_p > \lambda_\alpha$ (e) $\lambda_e, > \lambda_p > \lambda_\alpha$

79) The ratio of the de-Broglie wavelengths of an electron of energy 10 eV to that of a person of mass 66kg travelling with a speed of 100 km/h is of the order of

(a) 10^{34} (b) 10^{27} (c) 10^{17} (d) 10^{-10}

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

(a) increase by 2 times (b) decrease by 2 times (c) decrease by 4 times (d) increase by 4 times

81) After absorbing a slowly moving neutron of mass m_N (momentum$\sim$ 0) a nucleus of mass M breaks into two nuclei of masses m_1 and $5m_1$ ($6m_1$=M+m_N), respectively.If the de-Broglie wavelength of the nucleus with mass m_1 isλthen de Broglie wavelength of the other nucleus will be

(a) 25λ (b) 5λ (c) $\lambda/5$ (d) λ

82) An αparticle moves in a circular path of radius 0.83 cm in the presence of a magnetic field of 0.25 Wb/m^2.The de-Broglie wavelength associated with the particle will be:

(a) 1A (b) 0.1A (c) 10A (d) 0.01A

83) If the momentum of 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) 200 P (b) 400 P (c) P/200 (d) 100 P

84) An electron of mass m and a photon have same energy E.The ratio of de-Broglie wavelengths associated with them is(c being velocity of light)

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

85) If the wavelength of light in an experiment on photoelectric effect is doubled

(a) the photoelectric emission will not take place

(b) the photoelectric emission may or may not take place (c) the stopping potential will decrease

(d) the stopping potential will increase

86) Choose the incorrect statement:

(a) The velocity of photoelectrons is directly proportional to the square root of wavelength of light

(b) The number of photoelectrons emitted depends upon the intensity of incident light

(c) The velocity of photoelectrons is directly proportional to the frequency of incident light.

(d) The velocity of photoelectrons is inversely proportional to square root of the frequency of the light.

87) Photoelectric effect supports the quantum nature of light because

(a) there is minimum frequency of light below which no photoelectrons are emitted

(b) the maximum K.E. of photoelectrons emitted depends only on the frequency of the incident light and on its intensity

(c) even when metal surface is faintly illuminated, the photoelectrons leave the surface immediately

(d) electric charge of photoelectron is quantised

88) The maximum K.E of photoelectrons ejected from a photometer when it is irradiated with radiation of wavelength 400nmis 1eV.If the threshold energy of the surface is 1.9eV.

(a) the maximum K.E. of photoelectrons when it is irradiated with 500nm photons will be 0.42eV

(b) the maximum K.E. of photoelectrons when it is viradiated with 500nm photons will be 0.42eV

(c) maximum K.E will increase if the intensity of radiation is increased

(d) the longest wavelength which will eject the photoelectron from the surface is nearly 610nm

89) An electron and proton have the same de-Broglie wavelength.The K.E of the electron is

(a) zero (b) infinity (c) equal to K.E of the proton (d) greater than K.E. of proton

90) When a momentum point source of light is at a distance of 0.2m front a photoelectric cell, the cutoff voltage and the saturation current are respectively 0.6V and 18.0 mA.If the same source is placed 0.6m away from the photoelectric cell, then

(a) the stopping potential will be 0.2 volt (b) the stopping potential will be 0.6 volt

(c) the saturation current will be 6.0 mA (d) the saturation current will be 2.0 mA

91) Which of the following characteristics of photoelectric effect supports the particle nature of radiations

(a) threshold frequency (b) instantaneous photoelectric emission

(c) independent of the velocity of photo-electrons on intensity of radiations

(d) dependence of the velocity of photoelectrons on frequency

92) The frequency and intensity of a light source are both doubled.Which of the following statement(s) is/are true?

(a) The saturation photocurrent gets doubled.

(b) The saturation photocurrent remains almost the same.

(c) The maximum K.E. of the photoelectron is more than doubled.

(d) The maximum K.E. of the photoelectron gets doubled

93) If v is frequency,$\lambda$is the wavelength and $\overline{v}$is the wave number then the energy of a photon can be represented by

(a) hv (b) $hc\overline{v}$ (c) $hc\,\lambda$ (d) hc/λ

94) Lenard observed that no electrons are emitted when frequency of light is less than a certain minimum frequency. This minimum frequency depends on

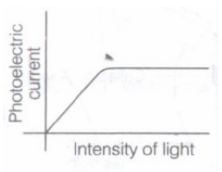
(a) potential differenceof emitter and collectorplates (b) distancebetween collectorand the emitter plate

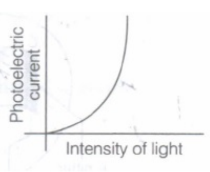
(c) size(area)of the emitter plate (d) material of the emitter plate

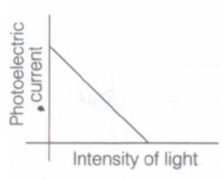
95) The work function of a metal is hc/ λ_0 If light of wavelength Ais incident on its surface, then the essential condition for the electron to come out from the metal surface is

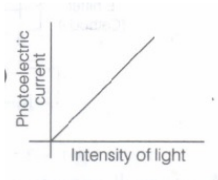
(a) $\lambda \geq \lambda_0$ (b) $\lambda \geq 2\lambda_0$ (c) $\lambda \leq \lambda_0$ (d) $\lambda \leq \lambda_0/2$

96) Variation of photoelectric current with intensity of light is

(a) 

(b) 

(c) 

(d) 

97) A photon of energy 3.4 eVis incident on a metal surface whose work function is 2 eV.Maximum kinetic energy of the photoelectron emitted by the metal surface will be

(a) 1.4 eV (b) 1.7 eV (c) 5.4 eV (d) 6.8 eV

98) Consider a beam of electrons (each electron with energy Eo) incident on a metal surface kept in an evacuated chamber. Then

(a) no electronswillbe emittedas onlyphotons can emit electrons

(b) electronscan be emittedbut all with an energy,E_0

(c) electronscan be emittedwith any energy,with a maximumof $E_0 - \varphi$ (φ is the work function)

(d) electronscan be emittedwith any energy,with a maximumof E_0

99) The formula for kinetic mass of a moving photon is

(a) hv/ λ (b) hλ/e (c) hv/e (d) h/cλ

100) The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1MeV energy is nearly

(a) 1.2 nm (b) 1.2 x 10^{-3} nm (c) 1.2 x 10^{-6}nm (d) 1.2 x 10 nm

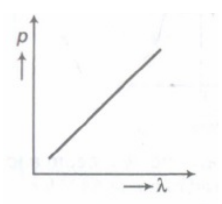
101) The de-Broglie wave of a moving particle does not depend on

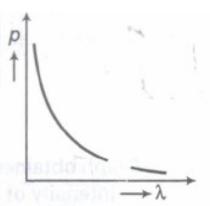
(a) mass (b) charge (c) Velocity (d) momentum

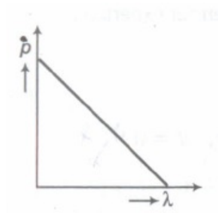
102) The de-Broglie wavelength of a particle of KE, K is λ. What will be the wavelength of the particle, if it's kinetic energy is $\frac{\bar{K}}{9}$?

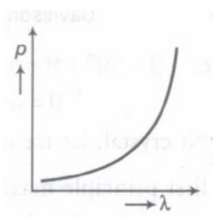
(a) λ (b) 2λ (c) 3λ (d) 4λ

103) Which of the following figures represent the variation of particle momentum and the associated-de-Broglie wavelength?

(a) 

(b) 

(c) 

(d) 

104) In the Davisson-Germer experiment, suppose the voltage applied to anode is increased. The diffracted beam will have the maximum at a value of θ that

(a) will be larger than the earlier value (b) willbe the sameas the earlier value

(c) will be less than the earlier value (d) will dependon the target

105) Work-function is

(a) maximumpossible energy acquired by an electron (b) energy of electrons in valence shell

(c) minimumenergy required by an electron to move out of metal surface

(d) maximumenergy which is given to electron to move it out ofmetal surface

106) The work function of platinum is 6.35 eV. The threshold frequency of platinum is

(a) 1532 x 10^{14} Hz (b) 1532 x 10^{16} Hz (c) 1532 x 10^{19} Hz (d) 1532 x 10^{18} Hz

107) With the increase in potential difference of emitter and collector, the photoelectric current

(a) increases (b) decreases (c) remains constant (d) increases initially and then become constant

108) The photoelectric threshold frequency of a metal is v. When light of frequency 6v is incident on the metal, the maximum kinetic energy of the emitted photo electron is

(a) 4hv (b) 5hv (c) 3hv (d) (3/2)hv

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

(a) $K_A < \frac{K_B}{2}$ (b) $2K_A = K_B$ (c) $K_A = 2K_B$ (d) $K_A > 2K_B$

110) All photons present in a light beam of single frequency have

(a) same frequency but different momentum (b) same momentum but different frequency

(c) different frequency and different momentum (d) same frequency and same momentum

111) The linear momentum of a 6 MeV photon is

(a) 0.01 eV sm^{-1} (b) 0.02 eV sm^{-1} (c) 0.03 eV sm^{-1} (d) 0.04 eV sm^{-1}

112) A photocell converts

(a) change in current into change in light intensity

(b) change in intensity of light into change in current (c) change in current into change in voltage

(d) change in intensity into change in potential difference

113) The de-Broglie wavelength (λ) of equal mass particles depends upon the mass in the following way

(a) $\lambda \propto m$ (b) $\lambda \propto m^{1/2}$ (c) $\lambda \propto m^{-1}$ (d) $\lambda \propto m^{-1/2}$

114) Light of frequency 1.9 times the threshold frequency is incident on a photosensitive material. If the frequency is halved and intensity is doubled, the photocurrent becomes

(a) quadrupled (b) doubled (c) halved (d) zero

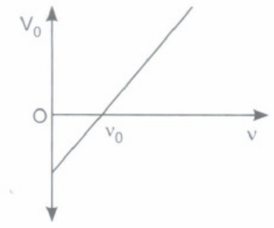
115) Threshold wavelength for a metal having work function W_0 is λ. What is the threshold wavelength for the metal having work function $2W_0$?

(a) 4λ (b) 2λ (c) λ/2 (d) λ/4

116) Radiations of frequency v are incident on a photosensitive metal. The maximum K.E. of the photoelectrons is E. When the frequency of the incident radiation is doubled, what is the maximum kinetic energy of the photoelectrons?

(a) 2E (b) 4E (c) E + hv (d) E - hv

117) The stopping potential Vo 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 the slope of the line and charge on electron

(c) intercept along y-axis divided by charge on the electron

(d) product of the intercept along x-axis and mass of the electron

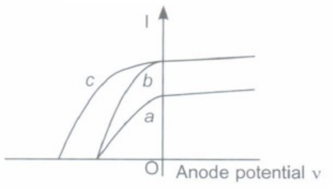
118) The energy of photon of wavelength 450 nm is

(a) 2.5×10^{-17} J (b) 1.25×10^{-17} J (c) 4.4×10^{-19} J (d) 2.5×10^{-19} J

119) The kinetic energy of an electron is 5 eV. Calculate the de broglie wavelength associated with it. (h = 6.6×10^{-34} Js, me = 9.1×10^{-31} kg)

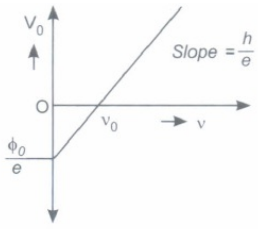
(a) $5.47\mathring{A}$ (b) $10.9\mathring{A}$ (c) $2.7\mathring{A}$ (d) None of these

120) The figure shows the variation of photocurrent with anode potential for a photosensitive surface for three different radiations. Let I_a, I_b and I_c be the intensities and v_a, v_b and v_c be the frequencies for the curves a, b and c respectively. Then the correct relation is



(a) $v_a = v_b$ and $I_a \neq I_b$ (b) $v_a = v_c$ and $I_a = I_c$ (c) $v_a = v_b$ and $I_a = I_b$ (d) $v_b = v_c$ and $I_b = I_c$

121) The slope of the stopping potential versus frequency graph for photoelectric effect is equal to



(a) h (b) he (c) h/e (d) e

122) A proton and an α-particle are accelerated by the same potential difference. The ratio of their de broglie wavelengths $(\lambda_p/\lambda_\alpha)$ is

(a) 1 (b) 2 (c) $\sqrt{8}$ (d) $\frac{1}{\sqrt{8}}$

123) Work function of three metals A, Band Care 4.5 eV, 4.3 eV and 3.5 eV respectively. If a light of wavelength 4000 $\mathring{A}$ is incident on the metals then

(a) photoelectrons are emitted from A. (b) photoelectrons are emitted from B.

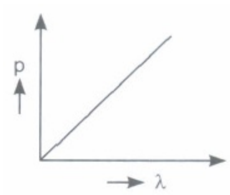
(c) photoelectrons are emitted from C. (d) photoelectrons are emitted from all the metals

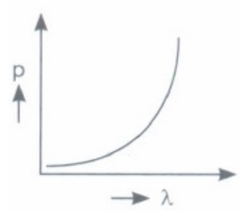
124) The photoelectric effect can be explained by

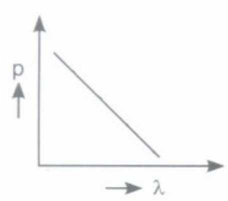
(a) Corpuscular theory of light (b) Wave nature of light (c) Bohr's theory

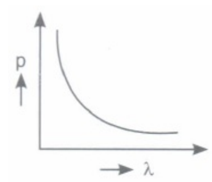
(d) Quantum theory of light

125) Which of the following figure represents the variation of particle momentum and associated de Broglie wavelength?

(a) 

(b) 

(c) 

(d) 

126) If K.E. of free electron is doubled, its de Broglie wavelength will change by factor

(a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$ (c) 1/2 (d) 2

127) Work function of metal is

(a) the minimum energy required to free an electron from surface against coulomb forces.

(b) the minimum energy required to free an nucleon (c) the minimum energy to ionise an atom.

(d) the minimum energy required to eject an electron orbit.

128) The rest mass of a photon of wavelength λ is

(a) zero (b) $\frac{h}{c\lambda}$ (c) $\frac{h}{\lambda}$ (d) $\frac{hc}{\lambda}$

129) Photoelectric effect is based on the law of conservation of

(a) energy (b) mass (c) linear momentum (d) angular momentum

130) Einstein's photoelectric equation is:

(a) $hv = hv_0 + \frac{1}{2}mv^2$ (b) $hv_0 = hv + \frac{1}{2}mv^2$ (c) $hv = hv_0 - \frac{1}{2}mv^2$ (d) $2hv = hv_0 + mv^2$

131) In photoelectric effect, the number of photoelectrons emitted is proportional to

(a) intensity of incident beam. (b) frequency of incident beam. (c) velocity of incident beam.

(d) work function of photo cathode.

132) For a given kinetic energy which of the following has smallest de Broglie wavelength?

(a) Electron (b) Proton (c) Deutron (d) α-particle

133) Which of the following shows particle nature of light?

(a) Photoelectric effect (b) Refraction (c) Interference (d) Polarisation

134) A proton, a neutron, an electron and an a-particle have same energy. Then their de Broglie wavelengths compare as

(a) $\lambda_p = \lambda_n > \lambda_e > \lambda_\alpha$ (b) $\lambda_\alpha < \lambda_p = \lambda_n < \lambda_e$ (c) $\lambda_e < \lambda_p = \lambda_n > \lambda_\alpha$ (d) $\lambda_e = \lambda_p = \lambda_n = \lambda_\alpha$

135) A particle moves in a closed orbit around the origin, due to a force which is directed towards the origin. The de Broglie wavelength of the particle varies cyclically between two values λ_1, λ_2 with $\lambda_1 > \lambda_2$ Which following statements are true?

(a) The particle could not be moving in a circular orbit with origin as centre.

(b) The particle could not be moving in an elliptic orbit with origin as its focus.

(c) When the de Broglie wavelength is λ_1 the particle is nearer the origin than when its value is λ_2.

(d) When the de Broglie wavelength λ_2, the particle is nearer the origin than when its value λ_1.

136) In photoelectric effect what determines the maximum velocity of electron reacting the collector?

(a) Frequency of incident radiation alone (b) Work function of metal

(c) Potential difference between the emitter and the collector (d) All of these

137) Consider the following statements:
I. According to de Broglie hypothesis, particles have wave-like characteristics.
II. When an electron and a proton have the same de Broglie wavelength, they will have equal momentum.
Which of the above statements is/are correct?

(a) I only (b) II only (c) both I and II (d) neither I nor II

138) A Proton and an α-particle have the same de Broglie wavelength. What is same for both of them?

(a) Mass (b) Energy (c) Frequency (d) Momentum

15 x 1 = 15

139) **Assertion (A)** : The threshold frequency of photoelectric effect supports the particle nature of light.
Reason (R) : If frequency of incident light is less than the threshold frequency, electrons are not emitted from metal surface.
Codes
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

140) **Assertion (A)** : Mass of moving photon varies inversely to the wavelength.

Reason (R) : Energy of the particle = Mass x (Speed of light)^2?

Codes:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

141) **Assertion (A)** : An electron microscope can achieve better resolving power than an optical microscope.

Reason (R) : The de- Broglie wavelength of the electrons emitted from an electron gun with velocity 500 ml s is much less than 500 nm.

Codes

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

142) **Assertion (A)** : Work function of aluminium is 4.2 ev' Emission of electrons will not be possible if two photons each of energy 2.5 eV stnike an electron of aluminium.

Reason (R) : For photoelectric emission the energy of each photon should be greater than the work function of aluminium.

Codes:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

143) **Assertion (A)** : Some photographic plates are not affected by red light but are immediately blackened by white light.

Reason (R) : The wavelength of red light is less than the wavelength of many components of white light.

Codes:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

144) **Assertion (A)** : The de-Broglie wavelength of particle having kinetic energy K is λ. If its kinetic energy becomes 4 K then its new wavelength would be $\lambda/2$.

Reason (R) : The de- Broglie wavelength λ is inversely proportional to square root of the kinetic energy.

Codes:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

145) **Assertion (A)** : In photo emissive cell inert gas is used.

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

Codes:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

146) **Assertion (A)** : Photosensitivity of a metal is high if its work function is small.

Reason (R) : Work function = hv_0 where v_0 is the threshold frequency.

Codes:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

147) **Assertion (A)** :A photon has no rest mass, yet it carries definite momentum.
Reason (R) : Momentum of photon is due to its energy and hence its equivalent mass.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

148) **Assertion (A)** : There is a physical significance of matter waves.
Reason (R) : Both interference and diffraction occurs in it.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false

149) **Assertion (A)** : Stopping potential depends upon the frequency of incident light but is independent of the intensity of the light.
Reason (R) : The maximum kinetic energy of the photoelectrons is proportional to stopping potential.
Codes:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the correct explanation of A
(c) A is true but R is false
(d) A is false and R is also false