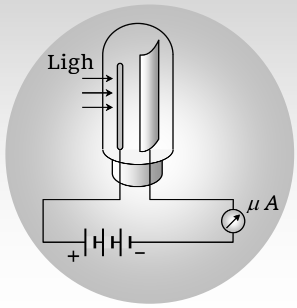


Assignment

Electron, cathode rays and positive rays

1. Order of e/m ratio of proton, α -particle and electron is **[AFMC 2004]**

(a) $e > p > \alpha$ (b) $p > \alpha > e$ (c) $e > \alpha > p$ (d) None of these

2. A cathode emits 1.8×10^{14} electrons per second, when heated. When 400*V* is applied to anode all the emitted electrons reach the anode. The charge on electron is $1.6 \times 10^{-19} C$. The maximum anode current is **[MP PMT 2004]**

(a) $2.7 \mu A$ (b) $29 \mu A$ (c) $72 \mu A$ (d) 29 *mA*

3. An electron is accelerated through a pd of 45.5 *volt*. The velocity acquired by it is (in ms^{-1})...... **[AIIMS 2004]**

(a) 4×10^6 (b) 4×10^4 (c) 10^6 (d) zero

4. The specific charge of an electron is **[MP PET/PMT 1998; J &K CET 2004]**

(a) 1.6×10^{-19} *coulomb* (b) 4.8×10^{-19} *stat coulomb* (c) 1.76×10^{11} *coulomb/kg* (d) 1.76×10^{-11} *coulomb/kg*

5. The colour of the positive column in a gas discharge tube depends on **[Kerala (Engg.) 2002]**

(a) The type of glass used to construct the tube (b) The gas in the tube

(c) The applied voltage (d) The material of the cathode

6. Cathode rays are produced when the pressure is of the order of **[Kerala (Engg.) 2002]**

(a) 2 *cm* of *Hg* (b) 0.1 *cm* of *Hg* (c) 0.01 *mm* of *Hg* (d) $1 \mu m$ of *Hg*

7. Which of the following is not the property of a cathode ray **[CBSE 2002]**

(a) It casts shadow (b) It produces heating effect

(c) It produces flurosence (d) It does not deflect in electric field

8. In Milikan's experiment, an oil drop having charge *q* gets stationary on applying a potential difference *V* in between two plates separated by a distance '*d*'. The weight of the drop is **[MP PET 2001]**

(a) qVd (b) $q\frac{d}{V}$ (c) $\frac{q}{Vd}$ (d) $q\frac{V}{d}$

9. In Thomson mass spectrograph $\vec{E} \perp \vec{B}$ then the velocity of electron beam will be **[CBSE PM/PD 2001]**

(a) $\left|\frac{\vec{E}}{\vec{B}}\right|$ (b) $\vec{E} \times \vec{B}$ (c) $\left|\frac{\vec{B}}{\vec{E}}\right|$ (d) $\frac{E^2}{B^2}$

10. Which is not true with respect to the cathode rays **[Kerala (Engg.) 2001]**

(a) A stream of electrons (b) Charged particles

(c) Move with speed same as that of light (d) Can be deflected by magnetic fields

11. An electron is accelerated through a potential difference of 200 *volts*. If *e/m* for the electron be 1.6×10^{11} *coulomb/kg*. the velocity acquired by the electron will be **[MP PET 2000]**

(a) $8 \times 10^{6} m/s$ (b) $8 \times 10^{5} m/s$ (c) $5.9 \times 10^{6} m/s$ (d) $5.9 \times 10^{5} m/s$

12. If the speed of electron is $5 \times 10^{5} m/s$. How long does one electron take to traverse 1*m* **[CET 1998; DPMT 2000]**

(a) $1 \times 10^{6} s$ (b) $2 \times 10^{-6} s$ (c) $2 \times 10^{5} s$ (d) $1 \times 10^{5} s$

13. A metal plate gets heated, when cathode rays strike against, it due to **[CPMT 2000]**

(a) Kinetic energy of cathode rays (b) Potential energy of cathode rays

(c) Linear velocity of cathode rays (d) Angular velocity of cathode rays

14. In Milikan's oil drop experiment, a charged drop falls with terminal velocity *V*. If an electric field *E* is applied in vertically upward direction then it starts moving in upward direction with terminal velocity 2*V*. If magnitude of electric field is decreased to $\frac{E}{2}$, then terminal velocity will become **[CBSE PMT 1999]**

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

15. The current conduction in a discharged tube is due to **[CBSE PMT 1999]**

(a) Electrons only (b) +*ve* ions and electrons

(c) – *ve* ions and electrons (d) + *ve* ions, – *ve* ions and electrons

16. Cathode rays and canal rays produced in a certain discharge tube are deflected in the same direction if **[SCRA 1998]**

(a) A magnetic field is applied normally (b) An electric field is applied normally

(c) An electric field is applied tangentially (d) A magnetic field is applied tangentially

17. Cathode rays enter into a uniform magnetic field perpendicular to the direction of the field. In the magnetic field their path will be **[MP PET/PMT 1998]**

(a) Straight line (b) Circle (c) Parabolic (d) Ellipse

18. Electric field and magnetic field in Thomson mass spectrograph are applied **[RPMT 1998]**

(a) Simultaneously, perpendicular (b) Perpendicular but not simultaneously

(c) Parallel but not simultaneously (d) Parallel simultaneously

19. The discovery of positive rays helped in the discovery of **[RPMT 1998]**

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

20. The ratio of momenta of an electron and α -particle which are accelerated from rest by a potential difference of 100 *V* is **[MNR 1994; RPET 1997]**

(a) 1 (b) $\sqrt{\frac{2m_e}{m_\alpha}}$ (c) $\sqrt{\frac{m_e}{m_\alpha}}$ (d) $\sqrt{\frac{m_e}{2m_\alpha}}$

21. In Millikan oil drop experiment, a charged drop of mass $1.8 \times 10^{-14} kg$ is stationary between its plates. The distance between its plates is 0.90 *cm* and potential difference is 2.0 *kilo volts*. The number of electrons on the drop is **[MP PMT 1994; MP PET 1997]**

(a) 500 (b) 50 (c) 5 (d) 0

22. The expected energy of the electrons at absolute zero is called **[RPET 1996]**

(a) Fermi energy (b) Emission energy (c) Work function (d) Potential energy

23. *K.E.* of emitted cathode rays is dependent on **[CPMT 1996]**

(a) Only voltage (b) Only work function

(c) Both (a) and (b) (d) It does not depend upon any physical quantity

24. In a discharge tube at 0.02 *mm*, there is a formation of **[CBSE PMT 1996]**

(a) FDS (b) CDS (c) Both space (d) None of these

25. A narrow electron beam passes undeviated through an electric field $E = 3 \times 10^4\ volt/m$ and an overlapping magnetic field $B = 2 \times 10^{-3}\ Weber/m^2$. The electron motion, electric field and magnetic field are mutually perpendicular. The speed of the electrons is **[MP PET 1995]**

(a) 60 *m/s* (b) $10.3 \times 10^7 m/s$ (c) $1.5 \times 10^7 m/s$ (d) $0.67 \times 10^{-7} m/s$

26. An oxide coated filament is useful in vacuum tubes because essentially **[SCRA 1994]**

(a) It has high melting point (b) It can withstand high temperatures

(c) It has good mechanical strength (d) I can emit electrons at relatively lower temperatures

27. Gases begin to conduct electricity at low pressure because **[CBSE 1994]**

(a) At low pressure, gases turn to plasma

(b) Colliding electrons can acquire higher kinetic energy due to increased mean free path leading to ionisation of atoms

(c) Atoms break up into electrons and protons

(d) The electrons in atoms can move freely at low pressure

28. When the speed of electrons increases, then the value of its specific charge **[MP PMT 1994]**

(a) Increases (b) Decreases

(c) Remains unchanged (d) Increases upto some velocity and then begins to decrease

29. Cathode rays moving with same velocity *v* describe an approximate cirular path of radius *r* metre in an electric field of strength *x volt/metre*. If the speed of the cathode rays is doubled to 2*v*, the value of electric field needed so that the rays describe the same approximate circular path (*volt / metre*) is **[BHU 1994]**

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

30. Cathode rays are similar to visible light rays in that **[SCRA 1994]**

(a) They both can be deflected by electric and magnetic fields (b) They both have a definite magnitude of wavelength

(c) They both can ionise a gas through which they pass (d) They both can expose a photographic plate

31. In Thomson's experiment if the value of *q/m* is the same for all positive ions striking the photographic plate, then the trace would be

[RPMT 1986]

(a) Straight line (b) Parabolic (c) Circular (d) Elliptical

32. The cathode rays have particle nature because of the fact that **[CPMT 1986; MNR 1986]**

(a) They can propagate in vacuum (b) They are deflected by electric and magnetic fields

(c) They produced fluorescence (d) They cast shadows

33. When cathode rays (tube voltage ~ 10 *kV*) collide with the anode of high atomic weight then we get **[MP PET 1985]**

(a) Positive rays (b) *X*-rays (c) Gamma rays (d) Canal rays

34. To produce positive rays the pressure in a discharge tube should be **[RPMT 1984]**

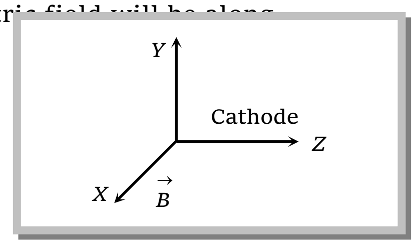
(a) Total vacuum (b) 10^{-3} to 10^{-4} atmospheric pressure

(c) One atmospheric pressure (d) 10^{-3} to 10^{-4} mm

35. Cathode-ray tube is a part of **[CPMT 1972]**

(a) Compound microscope (b) A radio receiver (c) A television set (d) A van de Graaf generator

36. In a region of space cathode rays move along +*ve* *Z*-axis and a uniform magnetic field is applied along X-axis. If cathode rays pass undeviated, the direction of electric field will be along



(a) – *ve* *X*-axis

(b) +ve *Y*-axis

(c) – ve *Y*-axis

(d) +ve *Z*-axis

37. A beam of electron whose kinetic energy is *E* emerges from a thin foil window at the end of an accelerator tube. There is a metal plate at a distance *d* from this window and at right angles to the direction of the emerging beam. The electron beam is prevented from hitting the plate *P*, if a magnetic field *B* is applied, which must be

(a) $B \geq \sqrt{\frac{2mE}{e^2d^2}}$, into the page (b) $B \geq \sqrt{\frac{2mE}{e^2d^2}}$, out of the page (c) $B \geq \sqrt{\frac{2mE}{ed}}$, into the page (d) $B \geq \left(\frac{2mE}{ed}\right)$, out of the page

38. In Thomson's experiment for determining *e/m*, the potential difference between the cathode and the anode (in the accelerating column) is the same as that between the deflecting plates (in the region of crossed fields). If the potential difference is doubled, by what factor should the magnetic field be increased to ensure that the electron beam remains undeflected

(a) $\sqrt{2}$ (b) 2 (c) $2\sqrt{2}$ (d) 4

39. In Thomson's experiment helium He^3 and He^4 exhibit parabolas. The equation of parabola for He^3 is $z^2 = 12Y$, then for He^4 the equation will be

(a) $Z^2 = 16Y$ (b) $Z^2 = 12Y$ (c) $Z^2 = 4Y$ (d) $Z^2 = 9Y$

Matter waves

40. An electron and a proton are accelerated through the same potential difference. The ratio of their De-Broglie wavelength will be **[J & K CET 2004]**

(a) $(m_p / m_e)^{1/2}$ (b) m_t / m_p (c) m_p / m_t (d) 1

41. An electron and proton have the same de-Broglie wavelength. Then the kinetic energy of the electron is **[Kerala PMT 2**

(a) Zero (b) Infinity

(c) Equal to the kinetic energy of the proton (d) Greater than the kinetic energy of the proton

42. For moving ball of cricket, the correct statement about de-Broglie wavelength is **[RPMT 2001]**

(a) It is not applicable for such big particle (b) $\frac{h}{\sqrt{2mE}}$

(c) $\sqrt{\frac{h}{2mE}}$ (d) $\frac{h}{2mE}$

43. Photon and electron are given same energy $(10^{-20} J)$. Wavelength associated with photon and electron are λ_{Ph} and λ_{el} then correct statement will be **[RPMT 2001]**

(a) $\lambda_{Ph} > \lambda_{el}$ (b) $\lambda_{Ph} < \lambda_{el}$ (c) $\lambda_{Ph} = \lambda_{el}$ (d) $\frac{\lambda_{el}}{\lambda_{Ph}} = C$

44. Wavelength associated with an electron of kinetic energy 54 *eV* is **[AMU (Engg.) 2000]**

(a) $1.66 \times 10^{-10} m$ (b) $2.6 \times 10^{-9} m$ (c) $3.5 \times 10^{-11} m$ (d) None of the above

45. The energy that should be added to an electron to reduce its de-Broglie wavelengths from 10^{-10} *m* to $0.5 \times 10^{-10} m$ will be

[KCET (Engg./Med.) 2000]

(a) Four times the initial energy (b) Thrice the initial energy

(c) Equal to the initial energy (d) Twice the initial energy

46. If the *K.E.* of an electron, a proton a neutron and an α-particle is identical, the maximum de-Broglie wavelength will be for

[CBSE PMT 1999]

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

47. Light of wavelength λ strikes a photo-sensitive surface and electrons are ejected with kinetic energy *E*. If the kinetic energy is to be increased to 2*E*, the wavelength must be changed to λ' where **[MP PET 1997]**

(a) $\lambda' = \frac{\lambda}{2}$ (b) $\lambda' = 2\lambda$ (c) $\frac{\lambda}{2} < \lambda' < \lambda$ (d) $\lambda' > \lambda$

48. The de-Brogile wavelength of electron is 10Å, then its velocity in *m/sec* will be **[Manipal 1997]**

(a) 7.2×10^5 (b) 72×10^4 (c) 7.2×10^{-5} (d) 7.2×10^6

49. An electron of mass *m*, accelerated through a potential difference *V* has de-Brogile wavelength λ. De-Broglie wavelength associated with a proton of mass *M* accelerated through same potential difference, will be **[CBSE PMT 1995]**

(a) $\lambda\left(\frac{m}{M}\right)$ (b) $\lambda\left(\frac{M}{m}\right)$ (c) $\lambda\sqrt{\frac{m}{M}}$ (d) $\lambda\sqrt{Mm}$

50. The accelerating voltage of an electron gun is 50,000 *volts*. de-Broglie wavelength of the electron will be **[RPMT 1995]**

(a) 0.55Å (b) 0.055 Å (c) 0.077 Å (d) 0.095 Å

51. The wavelength of *x*-ray photon is 0.01 Å, then its momentum in *Kg m/s* is **[RPMT 1995]**

(a) 6.63×10^{-22} (b) 6.63×10^{-24} (c) 6.63×10^{-46} (d) 6.63×10^{-32}

52. An proton moving with the velocity of $6.6 \times 10^5 m/\sec$ has a de-Broglie wavelength given by **[CPMT 1993]**

(a) 6×10^{-2} Å (b) 6×10^{-3} Å (c) 1 Å (d) 2 Å

53. A particle which has zero rest mass and non-zero energy and momentum must travel with a speed **[MP PMT 1992]**

(a) Equal to *c*, the speed of light in vacuum (b) Greater then *c*

(c) Less then *c* (d) Tending to infinity

54. The wavelengths of a photon, an electron and uranium atom are identical. Which of then will have highest energy **[MP PMT 1992]**

(a) Photon (b) Electron

(c) Uranium nucleus (d) Depends on wavelength and property of particles.

55. If E_1, E_2 and E_3 are the respective kinetic energies of an electron, an alpha particle and a proton each having the same De-Broglie wavelength then **[CBSE 1991]**

(a) $E_1 > E_3 > E_2$ (b) $E_2 > E_3 > E_1$ (c) $E_1 > E_2 > E_3$ (d) $E_1 = E_2 = E_3$

56. Momentum of a photon of electro - magnetic radiation radiation is 3.3×10^{-29} *kg-m-s*$^{-1}$. Then frequency of related waves is

[MP PET 1990]

(a) $3.0 \times 10^3\,Hz$ (b) $6.0 \times 10^2\,Hz$ (c) $7.5 \times 10^{12}\,Hz$ (d) $1.5 \times 10^{13}\,Hz$

57. The energy of electron with de-Broglie wavelength of 10^{-10} *m*, is (in *eV*) **[RPMT 1988]**

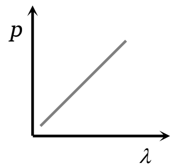
(a) 13.6 (b) 12.27 (c) 1.227 (d) 150.5

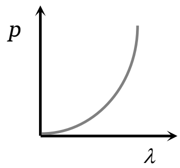
58. If there is an increase in linear dimensions of the object, the associated de-Broglie wavelength **[RPET 1986]**

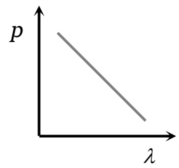
(a) Increases (b) Decreases

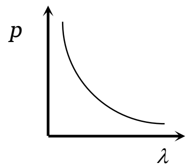
(c) Remains unchanged (d) Depends on the density of object

59. Which of the following figure represents the variation of particle momentum and the associated De-Broglie wavelength **[AIIMS 1982]**

(a) 

(b) 

(c) 

(d) 

60. On applying a potential difference of *V volt* on a proton, a wave of λ wavelength is obtained. The voltage applied to an α -particle to produce the same wavelength will be (in *volts*)

(a) *V* (b) *V*/5 (c) *V*/8 (d) 2*V*

61. Matter waves are

(a) Electromagnetic waves (b) Longitudinal waves (c) Probability waves (d)

62. Two sand grains, one of diameter 0.5 *mm* and the other of diameter 1.0 *mm* are moving with the same momentum, then the de-Broglie wavelength of the first is

(a) Greater than that of the second (b) Less than that of the second

(c) Equal to that of the second (d) Double incomparison to that of the second

63. An atom when undergoing a transition from an excited state to the ground state emits a photon of wavelength 1Å. Then, the recoil energy of the atom will be (assume mass of the atom = 40 *amu*)

(a) $3.3 \times 10^{-20}\,J$ (b) $1.3 \times 10^{-20}\,J$ (c) $3.3 \times 10^{-22}\,J$ (d) $6.6 \times 10^{-24}\,J$

64. The electron micro-scope works on the principle of

(a) Particle theory (b) Matter wave concept (c) Uncertainty (d) All of the above

65. The de-Broglie wavelength of an electron moving in the n^{th} Bohr orbit of radius *r* Å will be

(a) *nr* Å (b) $\frac{r}{n}$ Å (c) $\frac{2\pi r}{n}$ Å (d) $2\pi n$ Å

66. If the energy of a particle is reduced to half then the percentage increase in the de-Broglie wavelength is about

(a) 41% (b) 50% (c) 29% (d) 100%

67. The velocity of an electron in the ground state of hydrogen atom is 2.2×10^6 *m/s*. The De-Broglie wavelength associated with a muon in the ground state of a muonic hydrogen will be ($m_\mu = 207\, m_e$)

(a) 1.6 Å (b) 0.16 Å (c) 0.016 Å (d) 0.0016 Å

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

(a) $\frac{\Delta p}{200}$ (b) $\frac{\Delta p}{199}$ (c) $199\ \Delta p$ (d) $400\ \Delta p$

69. An electron and a photon have same wavelength. It p is the momentum of electron and E the energy of photon. The magnitude of p/E in S.I. unit is

(a) 3.0×10^8 (b) 3.33×10^{-9} (c) 9.1×10^{-31} (d) 6.64×10^{-34}

Photon/Photoelectric effect

70. According to Einstein's photoelectric equation, the plot of the kinetic energy of the emitted photo electrons from a metal *Vs* the frequency, of the incident radiation gives a straight line whose slope **[AIEEE 2004]**

(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 intensity of the radiation

71. The energy of incident photons corresponding to maximum wavelength of visible light is **[J & K CET 2004]**

(a) 3.2 *eV* (b) 7 *eV* (c) 1.55 *eV* (d) 1 *eV*

72. If the work function of potassium is 2*eV,* then its photoelectric threshold wavelength is

(a) 310 *nm* (b) 620 *nm* (c) 6200 *nm* (d) 3100 *nm*

73. Threshold wavelength for metal is 5200 Å. The photoelectrons will be ejected if it is irradiated by light from **[J & K CET**

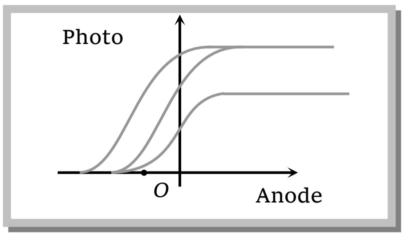
(a) 50 watt infrared lamp (b) 1 watt infrared lamp (c) 50 watt ultraviolet lamp (d)0.5 watt infrared lamp

74. The dual nature of light is exhibited by **[BCECE 2004]**

(a) Diffraction and photoelectric effect (b) Diffraction and reflection

(c) Refraction and interference (d) Photo electric effect

75. The figure shows the variation of photocurrent with anode potential for a photo-sensitive surface for three different radiations. Let I_a, I_b and I_c be the intensities and f_a, f_b and f_c be the frequencies for the curves *a, b* and c respectively. **[IIT-JEE (Screening) 2004]**



(a) $f_a = f_b$ and $I_a \neq I_b$

(b) $f_a = f_c$ and $I_a = I_c$

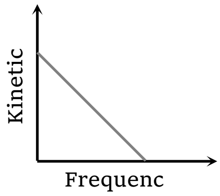
(c) $f_a = f_b$ and $I_a = I_b$

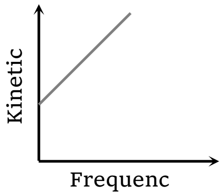
(d) $f_a = f_b$ and $I_b = I_c$

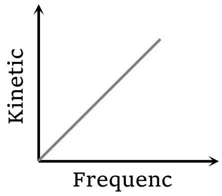
76. A photon of energy 4 *eV* is incident on a metal surface whose work function is 2 *eV*. The minimum reverse potential to be applied for stopping the emission of electrons is **[Similar to DCE 2000; AIIMS 2004]**

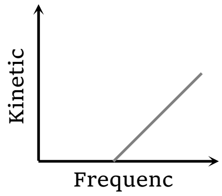
(a) 2 *V* (b) 4*V* (c) 6*V* (d) 8*V*

77. According to Einstein's photoelectric equation, the graph between the kinetic energy of photoelectrons ejected and the frequency of incident radiation is **[CBSE PMT 2004]**

(a) 

(b) 

(c) 

(d) 

78. Consider the two following statements *A* and *B* and identify the correct choice given in the answers

(A) In photovoltaic cells the photoelectric current produced is not proportional to the intensity of incident light.

(B) In gas filled photoemissive cells the velocity of photoelectrons depends on the wavelength of the incident radiation

[EAMCET (Engg.) 2003]

(a) Both *A* and *B* are true (b) Both *A* and *B* are false (c) *A* is true but *B* is false (d) *A* is false *B* is true

79. There are n_1 photons of frequency γ_1 in a beam of light. In an equally energetic beam, there are n_2 photons of frequency γ_2. Then the correct relation is **[KCET 2003]**

(a) $\frac{n_1}{n_2} = 1$ (b) $\frac{n_1}{n_2} = \frac{\gamma_1}{\gamma_2}$ (c) $\frac{n_1}{n_2} = \frac{\gamma_2}{\gamma_1}$ (d) $\frac{n_1}{n_2} = \frac{\gamma_1^2}{\gamma_2^2}$

80. Two identical photo-cathodes receive light of frequencies f_1 and f_2. If the velocities of the photo electrons (of mass *m*) coming out are respectively v_1 and v_2, then **[AIEEE 2003]**

(a) $v_1 - v_2 = \left[\frac{2h}{m}(f_1 - f_2)\right]^{1/2}$ (b) $v_1^2 - v_2^2 = \frac{2h}{m}(f_1 - f_2)$ (c) $v_1 + v_2 = \left[\frac{2h}{m}(f_1 + f_2)\right]^{1/2}$ (d) None of these

81. The frequency and work function of an incident photon are ν and ϕ_0. If ν_0 is the threshold frequency then necessary condition for the emission of photo electron is **[RPET 2003]**

(a) $\nu < \nu_0$ (b) $\nu = \frac{\nu_0}{2}$ (c) $\nu \geq \nu_0$ (d) None of these

82. Light of frequency ν is incident on a substance of threshold frequency $\nu_0(\nu_0 < \nu)$. The energy of the emitted photoelectron will be

[MP PET 2000, 2003]

(a) $h(\nu - \nu_0)$ (b) h/ν (c) $he(\nu - \nu_0)$ (d) h/ν_o

83. In a photoelectric effect experiment the slope of the graph between the stopping potential and the incident frequency will be

[UPSEAT 2003]

(a) 1 (b) 0.5 (c) 10^{-15} (d) 10^{-34}

84. Ultraviolet radiation of 6.2 *eV* falls on an aluminium surface (work function 4.2 *eV*). The kinetic energy in joules of the fastest electron emitted is approximately **[MNR 1987; MP PET 1990; CBSE 1993; RPMT 2001; BVP 2003]**

(a) 3.2×10^{-21} (b) 3.2×10^{-19} (c) 3.2×10^{-17} (d) 3.2×10^{-15}

85. In photoelectric emission the number of electrons ejected per second **[MH CET 1999; MP PMT 2002; KCET 2003]**

(a) Is proportional to the intensity of light (b) Is proportional to the wavelength of light

(c) Is proportional to the frequency of light (d) Is proportional to the work function of metal

86. When ultraviolet rays are incident on metal plate, then photoelectric effect does not occurs. It occurs by the incidence of **[CBSE 2002]**

(a) *X*-rays (b) Radio wave (c) Infrared rays (d) Green house effect

87. The threshold wavelength for photoelectric effect of a metal is 6500Å. The work function of the metal is approximately **[MP PET 2002]**

(a) 2 eV (b) 1 eV (c) 0.1 eV (d) 3 eV

88. Which of the following statements is correct **[JIPMER 2001, 2002]**

(a) The stopping potential increases with increasing intensity of incident light

(b) The photocurrent increases with increasing intensity of light

(c) The photocurrent is proportional to applied voltage

(d) The current in a photocell increases with increasing frequency of light

89. A caesium photocell with a steady potential difference of 60 V across is illuminated by a bright point source of light 50 cm away. When the same light is placed 1 m away the photoelectrons emitted from the cell **[KCET 2002]**

(a) Are one quarter as numerous (b) Are half as numerous

(c) Each carry one quarter of their previous momentum (d) Each carry one quarter of their previous energy

90. A radio transmitter radiates 1 kW power at a wavelength 198.6 m. How many photons does it emit per second **[Kerala**

(a) 10^{10} (b) 10^{20} (c) 10^{30} (d) 10^{40}

91. Photon of 5.5 eV energy fall on the surface of the metal emitting photoelectrons of maximum kinetic energy 4.0 eV. The stopping voltage required for these electrons are **[Orrisa (Engg.) 2002]**

(a) 5.5 V (b) 1.5 V (c) 9.5 V (d) 4.0 V

92. Energy of photon whose frequency is $10^{12}\,MHz$ will be **[MH CET 2002]**

(a) $4.14\times10^{3}\,keV$ (b) $4.14\times10^{2}\,eV$ (c) $4.14\times10^{3}\,MeV$ (d) $4.14\times10^{3}\,eV$

93. If a photon has velocity c and frequency ν, then which of following represents its wavelength **[AIEEE 2002]**

(a) $\frac{hc}{E}$ (b) $\frac{h\nu}{c}$ (c) $\frac{h\nu}{c^2}$ (d) $h\nu$

94. Light of frequency $4\nu_0$ is incident on the metal of the threshold frequency ν_0. The maximum kinetic energy of the emitted photoelectrons is **[MP PET 2002]**

(a) $3h\nu_0$ (b) $2h\nu_0$ (c) $\frac{3}{2}h\nu_0$ (d) $\frac{1}{2}h\nu_0$

95. When a metallic surface is illuminated by a monochromatic light of wavelength λ, then the potential difference required to stop the ejection of electrons is $3V_0$. When the same surface is illuminated by the light of wavelength 2λ, then the potential difference required to stop the ejection of electrons is V_0. Then for photoelectric effect, the threshold wavelength for the metal surface will be **[MP PMT 1987; AIII**

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

96. According to photon theory of light which of the following physical quantities associated with a photon do not / does not change as it collides with an electron in vacuum **[AMU (Engg.) 2001]**

(a) Energy and momentum (b) Speed and momentum (c) Speed only (d)

97. Which of the following is incorrect statement regarding photon **[MH CET (Med.) 2001]**

(a) Photon exerts no pressure (b) Photon energy is $h\nu$ (c) Photon rest mass is zero (d) None of these

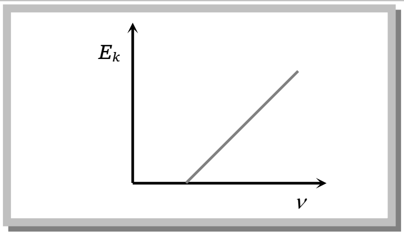
98. Light of frequency ν is incident on a certain photoelectric substance with threshold frequency ν_0. The work function for the substance is **[MP PMT 2001]**

(a) $h\nu$ (b) $h\nu_0$ (c) $h(\nu-\nu_0)$ (d) $h(\nu+\nu_0)$

99. Photons of energy 6 eV are incident on a metal surface whose work function is 4 eV. The minimum kinetic energy of the emitted photoelectrons will be **[MP PET 2001]**

(a) 0 eV (b) 1 eV (c) 2 eV (d) 10 eV

100. For the photoelectric effect, the maximum kinetic energy E_k of the emitted photoelectrons is plotted against the frequency ν of the incident photons as shown in the figure. The slope of the curve gives **[CPMT 1987; MP PET 2001]**



(a) Charge of the electron

(b) Work function of the metal

(c) Planck's constant

(d) Ratio of the Planck's constant to electronic charge

101. If intensity of incident light is increased in PEE then which of the following is true **[AIIMS 1998; RPET 2001]**

(a) Maximum *K. E.* of ejected electron will increase (b) Work function will remain unchanged

(c) Stopping potential will decrease (d) Maximum *K.E.* of ejected electron will decrease

102. Consider the following statements

Assertion (*A*) : The number of electrons emitted in the photoelectric effect depend upon the intensity of incident photon.

Reason (*R*) : The ejection of electrons from a metallic surface is not possible until frequency of incident photons is not more than threshold frequency. Of these statements **[AIIMS 2001]**

(a) Both *A* and *B* are true and the *R* is a correct explanation of the *A*

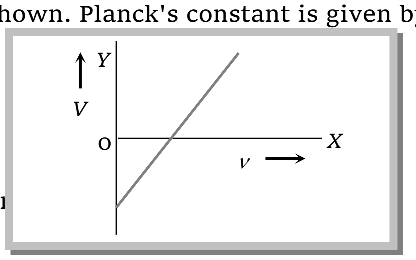
(b) Both *A* and *R* are true but the *R* is not a correct explanation of the *A*

(c) *A* is true but the *R* is false

(d) Both *A* and *R* are false

(e) *A* is false but the *R* is true

103. The stopping potential *V* for photoelectric emission from a metal surface is plotted along *Y*-axis and frequency ν of incident light along *X*-axis. A straight line is obtained as shown. Planck's constant is given by **[Similar to MP PMT 2**



(a) Slope of the line

(b) Product of slope on the line and charge on the electron

(c) Product of intercept along *Y*-axis and mass of the electron

(d) Product of Slope and mass of electron

104. Which of the following shows particle nature of light **[CBSE 2001; AFMC 2003]**

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

105. With the increase in the no. of incident photons

[CPMT 1999; MH CET (Med.) 2000; CBSE PMT 1999, 2000; KCET (Engg./Med.) 2001]

(a) Photoelectric current increases (b) Kinetic energy of photoelectrons increases

(c) Photoelectric current decreases (d) Kinetic energy of photoelectrons decreases

106. The frequency of a photon having energy 100 *eV* is $(h = 6.610^{-34}\ J - \text{sec})$ **[AFMC 2000]**

(a) $2.42 \times 10^{26}\ Hz$ (b) $2.42 \times 10^{16}\ Hz$ (c) $2.42 \times 10^{12}\ Hz$ (d) $2.42 \times 10^{9}\ Hz$

107. Consider the following statements

Assertion (A) : Photo emission from a photosensitive surface is possible only if the incident radiation has a frequency above threshold frequency.

Reason (R) : Unless $h\nu > W$, the work function (W) of photo-sensitive surface, no photo emission is possible.

Of these statements **[AIIMS 2000]**

(a) Both A and B are true and the R is a correct explanation of the A

(b) Both A and R are true but the R is not a correct explanation of the A

(c) A is true but the R is false

(d) Both A and R are false

(e) A is false but the R is true

108. Which light when falling on a metal will emit photo electrons **[DCE 2000]**

(a) Ultra-violet radiation (b) Infrared radiation (c) Radiowaves (d) Microwaves

109. Two radiation containing photons of energy twice and five times the work function of a metal are incident successively on the metal surface. The ratio of the maximum velocities of the emitted electrons in the two cases will be **[KCET 2000]**

(a) 1 : 4 (b) 1 : 3 (c) 1 : 1 (d) 1 : 2

110. If a photo cell is used for light of wavelength 4000 Å and if Na and Cu are used as cathode whose work function are 2eV and 4eV respectively then which will be better for cathode **[RPET 1999]**

(a) Na (b) Cu (c) Both (d) None of these

111. Energy required to remove an electron from an aluminium surface is 4.2 eV. If light of wavelength 2000Å falls on the surface, the velocity of fastest electron ejected from the surface is **[AMU 1999]**

(a) $2.5\times10^{7} m/s$ (b) $8.4\times10^{5} m/s$ (c) $6.7\times10^{6} m/s$ (d) $8.4\times10^{4} m/s$

112. If in a photoelectric experiment, the wavelength of incident radiation is reduced from 6000 Å to 4000 Å, then **[MP PM**

(a) Stopping potential will decrease (b) Stopping potential will increase

(c) Kinetic energy of emitted electrons will decrease (d) The value of work function will decrease

113. The maximum velocity of an electron emitted by light of wavelength λ incident on the surface of a metal of work function ϕ, is where h = Planck's constant, m = mass of electron and c = speed of light **[MP PET/PMT 1998]**

(a) $\left[\frac{2(hc+\lambda\phi)}{m\lambda}\right]^{1/2}$ (b) $\frac{2(hc-\lambda\phi)}{m}$ (c) $\left[\frac{2(hc-\lambda\phi)}{m\lambda}\right]^{1/2}$ (d) $\left[\frac{2(h\lambda-\phi)}{m}\right]^{1/2}$

114. Light of wavelength 5000Å falls on a sensitive plate with photoelectric work function of 1.9 eV. The kinetic energy of the photoelectron emitted will be **[CBSE 1998]**

(a) 0.58 eV (b) 2.48 eV (c) 1.24 eV (d) 1.16 eV

115. If mean wavelength of light radiated by 100 W lamp is 5000 $Å$, then number of photons radiated per second are **[RPET 1997]**

(a) 3×10^{23} (b) 2.5×10^{22} (c) 2.5×10^{20} (d) 5×10^{17}

116. When an inert gas is filled in the place vacuum in a photocell, then **[MP PMT 1997]**

(a) Photoelectric current is decreased

(b) Photoelectric current is increased

(c) Photoelectric current remains the same

(d) Decrease or increase in photoelectric current does no depend upon the gas filled

117. Energy conversion in a photoelectric cell takes place from **[AFMC 1993; MP PET 1996]**

(a) Chemical to electrical (b) Magnetic to electrical (c) Optical to electrical (d) Mechanical to electrical

118. When light of wavelength is 2537Å made incident on the copper surface, then the stopping potential is 0.24 *volt*. The threshold frequency of copper **[RPET 1996]**

(a) $1.124 \times 10^{15}\ Hz$ (b) $1.414 \times 10^{14}\ Hz$ (c) $2.248 \times 10^{15}\ Hz$ (d) None of the above

119. An image of the sun is formed by a lens of focal length of 30 *cm* on the metal surface of a photoelectric cell and a photoelectric current i is produced. The lens forming the image is then replaced by another of the same diameter but of focal length 15 *cm*. The photoelectric current in this case is **[Manipal MEE 1995]**

(a) $\frac{i}{2}$ (b) i (c) $2i$ (d) $4i$

120. Work function of a metal is 2.1 *eV*. Which of the waves of the following wavelengths will be able to emit photoelectrons from its surface **[Bihar MEE 1995]**

(a) 4000 Å, 7500 Å (b) 5500 Å, 6000 Å (c) 4000 Å, 6000 Å (d) None of these

121. Stopping potential for photoelectrons **[MP PET 1994]**

(a) Does not depend on the frequency of the incident light

(b) Does not depend upon the nature of the cathode material

(c) Depends on both the frequency of the incident light and nature of the cathode material

(d) Depends upon the intensity of the incident light

122. If the frequency of light in a photoelectric experiment is doubled the stopping potential will **[CPMT 1994]**

(a) Be doubled (b) Be halved (c) Become more than double (d) Become less then double

123. Two identical metal plates show photoelectric effect. Light of wavelength λ_A falls on plate A and λ_B falls on plate B. $\lambda_A = 2\lambda_B$. The maximum *K.E.* of the photoelectron is K_A and K_B respectively. Which one of the following statements is true **[CBSE 1993]**

(a) $2K_A = K_B$ (b) $K_A = 2K_B$ (c) $K_A < K_B / 2$ (d) $K_A > 2K_B$

124. When light of wavelength 300 *nm* (nanometer) falls on a photoelectric emitter, photoelctrons are liberated. For another emitter, however light of 600 *nm* wavelength is sufficient for creating photoemission. What is the ratio of the work functions of the two emitters

[CBSE 1993]

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

125. The kinetic energy of most energetic electrons emitted from a metallic surface is doubled when the wavelength λ of the incident radiation is changed from 400 *nm* to 310 *nm*. The work function of the metal is **[CBSE 1993]**

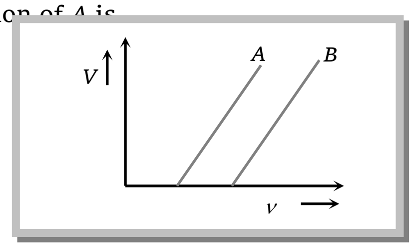
(a) 0.9 *eV* (b) 1.7 *eV* (c) 2.2 *eV* (d) 3.1 *eV*

126. Photo cell is a device to **[MP PET 1993]**

(a) Store photons (b) Measure light intensity

(c) Convert photon energy into mechanical energy (d) Store electrical energy for replacing storage batteries

127. The stopping potential as a function of the frequency of the incident radiation is plotted for two different photoelectric surfaces A and B. The graphs show that work function of A is **[DPMT 1992]**



(a) Greater than that of B

(b) Smaller than that of B

(c) Equal to that of B

(d) No inference can be drawn about their work functions from the given graphs

128. The *UV* photon is incident on a metal of photoelectric work function 2 *eV* and produces a photoelectron of energy 2 *eV*. The wavelength associated with the photon is **[CBSE 1991]**

(a) 3100 Å (b) 6200 Å (c) 9300 Å (d) 4900 Å

129. Photoelectric work function of a metal is 1 *eV*. Light of wavelength 3000 Å falls on it. The photoelectrons come out with velocity

[CBSE 1990]

(a) $10\ ms^{-1}$ (b) $10^3\ ms^{-1}$ (c) $10^4\ ms^{-1}$ (d) $10^6\ ms^{-1}$

130. Threshold frequency for a metal is $10^{15}\ Hz$, when the light of 4000 Å wavelength incident on it, then choose the correct statement

[MP PMT 1990]

(a) Photoelectric effect will not happen (b) Photoelectrons will be emitted with zero velocity

(c) Photoelectrons will be emitted with the velocity of $10^3\ m/sec$. (d) Photoelectrons will be emitted with the velocity of $10^5\ m/sec$.

131. The work function for tungsten and sodium are 4.5 *eV* and 2.3 *eV* respectively. If the threshold wavelength λ for sodium is 5460 Å, the value of λ for tungsten is **[MP PET 1990]**

(a) 5893 Å (b) 10683 Å (c) 2791 Å (d) 528 Å

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

[CBSE 1990; MP PET 1990]

(a) 1.72×10^{31} (b) 1327×10^{34} (c) 13.27×10^{34} (d) 0.075×10^{-34}

133. A and B are two light sources. Intensity of source A is more than that of B and frequency of source B is more than that of A. The current obtained for the photocell is **[MP PET 1988]**

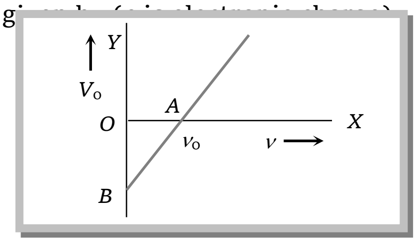
(a) More for source A (b) More for source B (c) Same for both the sources (d) Nothing can be said

134. Which of the following statement is not related to photon **[MP PET 1988]**

(a) Its energy does not depends on frequency (b) Its energy depends on frequency

(c) It moves always with the velocity of light (d) Its wave is electromagnetic

135. In an experiment on photoelectric effect the frequency f of the incident light is plotted against the stopping potential V_0. The work function of the photoelectric surface is g **[CPMT 1987]**



(a) $OB \times e$ in *eV*

(b) OB in *volt*

(c) OA in *eV*

(d) The slope of the line AB

136. When the photons of energy $h\nu$ fall on a photo-sensitive surface (work function $h\nu_0$) electrons are emitted from the metallic surface. This is known as photoelectric effect. The electron coming out of the surface have a kinetic energy. Then it is possible to state that

[NCERT 1983]

(a) All ejected electrons have the same *K.E.* equal to $h\nu - h\nu_0$

(b) The ejected electrons have a distribution of kinetic energy, the most energetic one have kinetic energy equal to $h\nu - h\nu_0$

(c) The most energetic ejected electrons have kinetic energy equal to $h\nu$

(d) The kinetic energy of the most energetic ejected electrons is $h\nu_0$

137. Monochromatic light, incident on a metal surface emits photoelectrons whose energies range from zero to 2.5 *eV*. What will be the minimum energy of incident photon if the energy required to release the tightly bound electron is 4.2*eV*

(a) 1.6 *eV* (b) 1.6 eV to 6.8 *eV* (c) 6.8 *eV* (d) > 6.8 *eV*

138. The eye can detect $5 \times 10^4 \text{Photons}/m^2 - \sec$ of green light ($\lambda = 5000\,Å$), while ear can detect $10^{-13}\,\text{watt}/m^2$. As a power electron, which is more sensitive and by what factor

(a) Eye is more sensitive and by a factor of 5.00 (b) Ear is more sensitive by a factor of 5.00

(c) Both are equally sensitive (d) Eye is more sensitive by a factor of 10^{-1}

139. When light of intensity 1 W/m^2 and wave length $5 \times 10^{-7}\ m$ is incident on a surface, it is completely absorbed by the surface. If 100 photons emit one electron and area of the surface is $1 cm^2$, then the photoelectric current will be

(a) 2 *mA* (b) 0.4 μA (c) 4.0 *mA* (d) 4 μA

X-rays

140. The X-ray can not be diffracted by means of an ordinary grating due to

(a) Large wavelength (b) High speed (c) Short wavelength (d) All of these

141. *X*-ray will travel minimum distance in **[MP PET 2003]**

(a) Air (b) Iron (c) Wood (d) Water

142. The minimum wavelength of *X*-ray emitted by *X*-rays tube is 0.4125 Å. The accelerating voltage is

(a) 30 *kV* (b) 50 *kV* (c) 80 *kV* (d) 60 *kV*

143. Characteristic *X*-rays are produced due to **[AIIMS 2003]**

(a) Transfer of momentum in collision of electrons with target atoms

(b) Transition of electrons from higher to lower electronic orbits in an atom

(c) Heating of the target

(d) Transfer of energy in collision of electrons with atoms in the target

144. *X*-rays when incident on a metal

(a) Exert a force on it (b) Transfer energy to it (c) Transfer pressure to it (d) All of the above

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

[CPMT 1986; 88, 91; RPMT 1997; MP PET 1997; MP PMT/PET 1998; MP PMT 1996, 2003]

(a) $\frac{eV}{hc}$ (b) $\frac{eh}{cV}$ (c) $\frac{hc}{eV}$ (d) $\frac{cV}{eh}$

146. An X-ray machine is working at a high voltage. The spectrum of the X-rays emitted will

(a) Be a single wavelength (b) Extend from 0 to ∞ wavelength

(c) Extend from a minimum to ∞ wavelength (d) Extend from 0 to a maximum wavelength

147. What is the difference between soft and hard *X*-rays

(a) Velocity (b) Intensity (c) Frequency (d) Polarization

148. X-rays are produced due to

(a) Break up of molecules (b) Change in atomic energy level

(c) Change in nuclear energy level (d) Radioactive disintegration

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

(a) γ-rays have smaller wavelength than X-rays

(b) γ-rays emanate from nucleus while X-rays emanate from outer part of the atom

(c) γ-rays have grater ionizing power than X-rays

(d) γ-rays are more penetrating than X-rays

150. X-ray beam can be deflected by

(a) Magnetic field (b) Electric field (c) Both (a) and (b) (d) None of these

151. For the production of characteristic K_γ, X-ray, the electron transition is

(a) $n=2$ to $n=1$ (b) $n=3$ to $n=2$ (c) $n=3$ to $n=1$ (d) $n=4$ to $n=1$

152. When X rays pass through a strong uniform magnetic field, then they

(a) Do not get deflected at all (b) Get deflected in the direction of the field

(c) Get deflected in the direction opposite to the field (d) Get deflected in the direction perpendicular to the field

153. If the potential difference applied across X-ray tube is V volts, then approximately minimum wavelength of the emitted X-rays will be

[CBSE 1996; MP PET 2002]

(a) $\frac{1227}{\sqrt{V}} Å$ (b) $\frac{1240}{V} Å$ (c) $\frac{2400}{V} Å$ (d) $\frac{12400}{V} Å$

154. If V be the accelerating voltage, then the maximum frequency of continuous X-rays is given by

[NCERT 1971; CPMT 1991; MP PET 2000; MP PMT 2002]

(a) $\frac{eh}{V}$ (b) $\frac{hV}{e}$ (c) $\frac{eV}{h}$ (d) $\frac{h}{eV}$

155. A metal block is exposed to beams of X-ray of different wavelength X-rays of which wavelength penetrate most

[NCERT 1980; JIPMER 2002]

(a) 2Å (b) 4Å (c) 6Å (d) 8Å

156. An X-ray tube operates on 30 kV. What is the minimum wavelength emitted ? ($h = 6.6 \times 10^{-34}$ Js, $e = 1.6 \times 10^{-19}$ *coulomb*, $c = 3 \times 10^8$ ms^{-1})

(a) 0.133 Å (b) 0.4 Å (c) 1.2 Å (d) 6.6 Å

157. Bragg's law for X-rays is **[UPSEAT 2001]**

(a) $d \sin \theta = 2n\lambda$ (b) $2d\sin\theta = n\lambda$ (c) $n\sin\theta = 2\lambda d$ (d) None of these

158. Intensity of X-rays depends upon the number of **[SCRA 1998; DPMT 2000; AFMC 2001]**

(a) Electrons (b) Protons (c) Neutrons (d) Positrons

159. In an X-ray tube electrons bombarding the target produce X-rays of minimum wavelength 1 Å. What must be the energy of bombarding electrons

(a) 13375 eV (b) 12375 eV (c) 14375 eV (d) 15375 eV

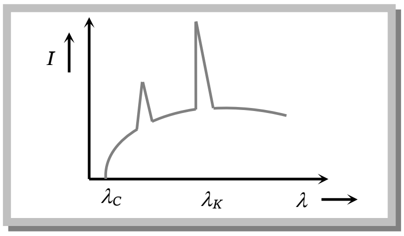
160. For production of characteristic K_β X-rays, the electron transition is

(a) $n=2$ to $n=1$ (b) $n=3$ to $n=2$ (c) $n=3$ to $n=1$ (d) $n=4$ to $n=2$

161. Penetrating power of X-rays does not depend on **[MP PET 2001]**

(a) Wavelength (b) Energy (c) Potential difference (d) Current in the filament

162. The intensity of X-rays from a coolidge tube is plotted against wavelength as shown in the figure. The minimum wavelength found is λ_c and the wavelength of the K_α line is λ_k. As the accelerating voltage is increased



(a) $(\lambda_K - \lambda_C)$ increases

(b) $(\lambda_K - \lambda_C)$ decreases

(c) λ_K increases

(d) λ_K decreases

163. Penetrating power of X-rays can be increased by **[MP PMT 1997, 2000]**

(a) Increasing the potential difference between anode and cathode

(b) Decreasing the potential difference between anode and cathode

(c) Increasing the cathode filament current

(d) Decreasing the cathode filament current

164. In an X-ray tube the intensity of the emitted X-ray beam is increased by

(a) Increasing the filament current (b) Decreasing the filament current

(c) Increasing the target potential (d) Decreasing the target potential

165. X-rays are **[CPMT 1975; EAMCET 1995; RPET 2000]**

(a) Stream of electrons (b) Stream of positively charged particles

(c) Electromagnetic radiations (d) Stream of uncharged particles

166. For the structural analysis of crystals, X-rays are used because

(a) X-rays have wavelength of the order of interatomic spacing (b) X-rays are highly penetrating radiations

(c) Wavelength of X-rays is of the order of nuclear size (d) X-rays are coherent radiations

167. Electrons with energy 80 *keV* are incident on the tungsten target of an *X*-ray tube. *K* shell electrons of tungsten have – 72.5 *keV* energy. *X*-rays emitted by the tube contain only

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

(b) A continuous X-ray spectrum (Bremsstrahlung] with all wavelengths

(c) The characteristic X-rays spectrum of tungsten

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

168. The wavelength of most energetic X-rays emitted when a metal target is bombarded by 40 *keV* electrons, is approximately

($h = 6.62 \times 10^{-34}$ *J-sec*; $1eV = 1.6 \times 10^{-19}$ *J*; $c = 3 \times 10^8$ *m/s*)

(a) 300 Å (b) 10 Å (c) 4 Å (d) 0.31 Å

169. Consider the following two statements *A* and *B* and identify the correct choice in the given answer

A : The characteristic *X*-ray spectrum depends on the nature of the material of the target.

B : The short wavelength limit of continuous X-ray spectrum varies inversely with the potential difference applied to the *X*-rays tube

[EAMCET (Med.) 2000]

(a) A is true and B is false (b) A is false and B is true (c) Both A and B are true (d) Both A and B are false

170. The energy of an X ray photon of wavelength 1.65 Å is $(h = 6.6 \times 10^{-34}\ J\text{-}sec,\ c = 3 \times 10^{8}\ ms^{-1},\ 1eV = 1.6 \times 10^{-19}\ J)$

[EAMCET (Engg.) 2000]

(a) 3.5 keV (b) 5.5 keV (c) 7.5 keV (d) 9.5 keV

171. The X-ray beam coming from an X-ray tube will be **[IIT-JEE 1985; SCRA 1996; MP PET 1999]**

(a) Monochromatic

(b) Having all wavelengths smaller than a certain maximum wavelength

(c) Having all wavelengths larger than a certain minimum wavelength

(d) Having all wavelengths lying between a minimum and a maximum wavelength

172. Molybdenum is used as a target element for production of X-rays because it is **[CPMT 1980; RPET 1999]**

(a) A heavy element and can easily absorb high velocity electrons (b) A heavy element with a high melting point

(c) An element having high thermal conductivity (d) Heavy and can easily deflect electrons

173. K_a characteristic X-ray refers to the transition **[MP PMT 1999]**

(a) n = 2 to n = 1 (b) n = 3 to n = 2 (c) n = 3 to n = 1 (d) n = 4 to n = 2

174. What kV potential is to be applied on X-ray tube so that minimum wavelength of emitted X-rays may be 1Å (h = 6.625 × 10^{-34} $J\text{-}sec$)

[UPSEAT 1999]

(a) 12.42 kV (b) 12.84 kV (c) 11.98 kV (d) 10.78 kV

175. X-rays are not obtainable from H-atom because **[RPET 1999]**

(a) It is a gas (b) It is very light

(c) The difference in energy levels of H-atom is very small (d) The difference in energy levels of H-atoms is very large

176. Energy of X-rays is about **[MP PMT 1999]**

(a) 8 eV (b) 80 eV (c) 800 eV (d) 8000 eV

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

(a) A maximum wavelength (b) A minimum wavelength (c) A single wavelength (d)

178. X-ray beam of intensity I_0 passes through an absorption plate of thickness d. If absorption coefficient of material of plate is μ, the correct statement regarding the transmitted intensity I of X-ray is

(a) $I = I_0(1 - e^{-\mu d})$ (b) $I = I_0 e^{-\mu d}$ (c) $I = I_0(1 - e^{-\mu / d})$ (d) $I = I_0 e^{-\mu / d}$

179. X-rays are produced in X-ray tube operating at a given accelerating voltage. The wavelength of the continuous X-rays has values from

[IIT-JEE 1998]

(a) 0 to ∞ (b) $\lambda_{\min}$ to ∞, where $\lambda_{\min} > 0$

(c) 0 to $\lambda_{\max}$, where $\lambda_{\max} < \infty$ (d) $\lambda_{\min}$ to $\lambda_{\max}$, where $0 < \lambda_{\min} < \lambda_{\max} < \infty$

180. The emission of K_a X-rays from tungsten is at a wavelength of 0.021nm. The energy difference between the K and L energy levels will be approximately

(a) 0.51 MeV (b) 1.2 MeV (c) 59 KeV (d) 13.6 eV

181. Compton effect shows that **[DPMT 1995]**

(a) X-rays are waves (b) X-rays have high energy (c) X-rays can penetrate matter (d)

182. The wavelength of K_α X-rays produced by an X-ray tube is 0.76$Å$. The atomic number of the anode material of the tube is

[IIT-JEE 1996]

(a) 20 (b) 60 (c) 40 (d) 80

183. X-ray astronomy **[Haryana CEE 1996]**

(a) Orbiting the earth because X-rays are almost completely absorbed by the atmosphere

(b) Is very much possible through the use of appropriate telescopes kept on the earth because the atmosphere is almost completely transparant to X-rays

(c) Is possible both with satellites and on the earth because the atmosphere does not affect X-rays at all

(d) Is not possible at all because X-rays have a very short wavelength

184. An X-ray tube with a copper target emits $Cu\ K_\alpha$ line of wavelength 1.50 Å. What should be the minimum voltage through which electrons are to be accelerated to produce this wavelength of X rays ($h = 6.63 \times 10^{-34}$ *J-sec*, $c = 3 \times 10^8\ m/s$) **[Orissa JEE 1996]**

(a) 8280 V (b) 828 V (c) 82800 V (d) 8.28 V

185. An X-ray tube is operating at 50 kV and 20 mA. The target material of the tube has a mass of 1.0 kg and specific heat 495 $Jkg^{-1}\,{}^\circ C$. One percent of the supplied electric power is converted into X-rays and the entire remaining energy goes into heating the target. Then

[IIT-JEE 1995]

(1) A suitable target material must have a high melting temperature

(2) A suitable target material must have low thermal conductivity

(3) The average rate of rise of temperature of target would be $2^\circ C/s$

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

(a) 1, 3, 4 (b) 1, 2, 3 (c) 2, 3, 4 (d) None of these

186. In X-ray spectrum wavelength λ of line K_α depends on atomic number Z as **[RPMT 1995]**

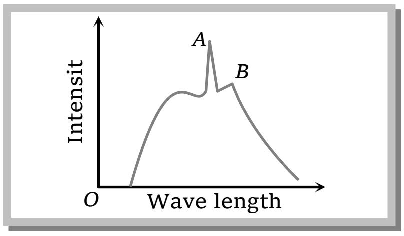
(a) $\lambda \propto Z^2$ (b) $\lambda \propto (Z-1)^2$ (c) $\lambda \propto \frac{1}{(Z-1)}$ (d) $\lambda \propto \frac{1}{(Z-1)^2}$

187. The energy of a photon of characteristic X-ray from a Coolidge tube comes from **[MP PET 1995]**

(a) The kinetic energy of the striking electron (b) The kinetic energy of the free electrons of the target

(c) The kinetic energy of the ions of the target (d) An electronic transition of the target atom

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



(a) Band spectrum

(b) Continuous spectrum

(c) Characteristic radiations

(d) White radiations

189. When a beam of accelerated electron hits a target a continuous X-ray spectrum is emitted from the target. Which of the following wavelength is absent in the X-ray spectrum. If the X-ray in operating at 40,000 volts **[NCERT 1**

(a) 0.25 Å (b) 0.5 Å (c) 1.5 Å (d) 1.0 Å

190. Absorption of X-ray is maximum in which of the following different sheets **[RPMT 1995]**

(a) Copper (b) Gold (c) Beryllium (d) Lead

191. Which of the following is accompanied by the characteristic X-ray emission **[MP PET 1993]**

(a) α-particle emission (b) Electron emission (c) Positron emission (d) K-electron capture

192. A potential difference of 42,000 *volts* is used in an X-ray tube to accelerate electrons. The maximum frequency of the X-radiations produced is ($1\ eV = 1.6 \times 10^{-19}\ J$ and $h = 6.63 \times 10^{-34}$ *J-sec*)

(a) $10^{19}\ Hz$ (b) $10^{18}\ Hz$ (c) $10^{16}\ Hz$ (d) $10^{20}\ Hz$

193. A direct X-ray photograph of the intestines is not generally taken by the radiologists because

(a) Intestines would burst on exposure to X-rays

(b) The X-rays would not pass thruogh the intestines

(c) The X-rays will pass through the intestines without causing a good shadow for any useful diagnosis

(d) A very small exposure of X-rays causes cancer in the intestines

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

[MP PMT 1987]

(a) $\lambda_1 = \frac{1}{\lambda_2}$ (b) $\lambda_1 = \lambda_2$ (c) $\lambda_1 > \lambda_2$ (d) $\lambda_1 < \lambda_2$

195. The binding energy of the innermost electron in tungsten is 40 keV. To produce characteristic X-rays using a tungsten target in an X-ray tube the potential difference V between the cathode and the anticathode should be **[IIT-JEE 1985]**

(a) $V < 40\ kV$ (b) $V \le 40\ kV$ (c) $V > 40\ kV$ (d) $V > / < 40\ kV$

196. The wavelength of K_α-line in copper is 1.54 Å. The ionisatin energy of K electron in copper in *Joule* is **[EAMCET 19**

(a) 11.2×10^{-27} (b) 12.9×10^{-16} (c) 1.7×10^{-15} (d) 10×10^{-16}

197. The characteristic X-ray radiation is emitted when **[CPMT 1975, 80, 90; RPET 1999]**

(a) The electrons are accelerated to a fixed energy

(b) The source of electrons emits a monenergetic beam

(c) The bombarding electrons knock out electrons from the inner shell of the target atoms and one of the outer electrons falls into this vacancy

(d) The valence electrons in the target atom are removed as a result of the collision

198. In radio-theraphy, X-rays are used to **[CPMT 1972]**

(a) Detect bone fractures (b) Treat cancer by controlled exposure

(c) Detect heart diseases (d) Detect fault in radio receiving circuits

199. In obtaining an X-ray photograph of our hand, we use the principle of **[CPMT 1972]**

(a) Shadow photography (b) Image formation by an optical system

(c) Photoelectric effect (d) Positive rays

200. X-rays are not used for radar purpose because

(a) They are not reflected by the target (b) They are not electromagnetic waves

(c) They are completely absorbed by the air (d) They sometimes damage the target

201. The wavelength of K_α line for an element of atomic number 43 is λ. Then the wavelength of K_α line for an element of atomic number 29 is

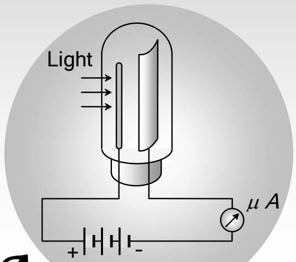
(a) $\frac{43}{29}\lambda$ (b) $\frac{42}{28}\lambda$ (c) $\frac{9}{4}\lambda$ (d) $\frac{4}{9}\lambda$

202. Let λ_α, λ_β and λ'_α denote the wavelengths of the X-rays of the K_α, K_β and L_α lines in the characteristic X-rays for a metal

(a) $\lambda'_\alpha > \lambda'_\alpha > \lambda_\beta$ (b) $\lambda'_\alpha > \lambda_\beta > \lambda_\alpha$ (c) $\frac{1}{\lambda_\beta} = \frac{1}{\lambda_\alpha} + \frac{1}{\lambda'_\alpha}$ (d) $\frac{1}{\lambda_\alpha} + \frac{1}{\lambda_\beta} = \frac{1}{\lambda'_\alpha}$

203. In a Coolidge tube, the potential difference across the tube is 20 kV, and 10 mA current flows through the voltage supply. Only 0.5% of the energy carried by the electrons striking the target is converted into X-rays. The X-ray beam carries a power of

(a) 0.1 W (b) 1 W (c) 2 W (d) 10 W



Answer Sheet

Assignments

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	b	a	c	b	c	d	d	a	c	a	b	a	c	d	a	b	d	b	d
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
c	a	c	b	c	d	b	b	c	d	b	b	b	d	c	c	b	a	d	a
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	b	a	a	a	a	c	a	c	b	a	a	a	d	a	d	d	c	d	c
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
c	c	c	b	c	a	c	c	b	d	c	b	c	a	a	a	d	d	c	b
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
c	a	c	b	a	a	a	b	a	c	b	d	a	a	c	b	a	b	a	c
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	b	b	d	a	b	a	a	d	a	b	b	c	a	c	b	c	a	b	d
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
c	c	c	b	c	b	b	a	d	a	c	a	a	a	a	b	c	a	b	c
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
b	a	a	d	c	c	c	b	b	d	d	a	d	c	a	b	b	a	b	c
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
d	a	a	a	c	a	d	d	c	c	c	b	a	a	c	d	b	b	b	c
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
d	c	a	a	a	d	d	c	a	d	d	a	c	c	c	c	c	b	a	a
201	202	203																	
c	c	b																	