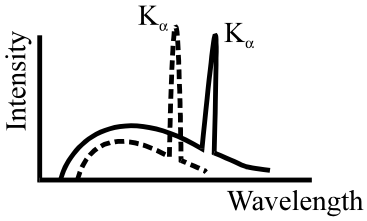
1. Figure shows the intensity-wavelength relations of X-rays coming from two different Coolidge tubes. The solid curve represents the relation for the tube A in which the potential difference between the target and the filament is V_A and the atomic number of the target material is Z_A. These quantities are V_B and Z_B for the other tube. Then,



(A) $V_A > V_B, Z_A > Z_B$ (B) $V_A > V_B, Z_A < Z_B$
(C) $V_A < V_B, Z_A > Z_B$ (D) $V_A < V_B, Z_A < Z_B$

2. The relation between λ_1: wavelength of series limit of Lyman series, λ_2: the wavelength of the series limit of Balmer series & λ_3: the wavelength of first line of Lyman series is :

(A) $\lambda_1 = \lambda_2 + \lambda_3$ (B) $\lambda_3 = \lambda_1 + \lambda_2$ (C) $\lambda_2 = \lambda_3 - \lambda_1$ (D) none of these

3. If λ_{min} is minimum wavelength produced in X-ray tube and $\lambda_{k\alpha}$ is the wavelength of k_α line. As the operating tube voltage is increased.

(A) $(\lambda_k - \lambda_{min})$ increases (B) $(\lambda_k - \lambda_{min})$ decreases (C) $\lambda_{k\alpha}$ increases (D) λ_{ka} decreases

4. If the frquency of K_α X-ray emitted from the element with atomic number 31 is f, then the frequency of K_α X-ray emitted from the element with atomic number 51 would be

(A) $\frac{5f}{3}$ (B) $\frac{51f}{31}$ (C) $\frac{9f}{25}$ (D) $\frac{25f}{9}$

5. According to Moseley's law the ratio of the slopes of graph between $\sqrt{\nu}$ and Z for K_β and K_α is :

(A) $\sqrt{\frac{32}{27}}$ (B) $\sqrt{\frac{27}{32}}$ (C) $\sqrt{\frac{33}{22}}$ (D) $\sqrt{\frac{22}{33}}$

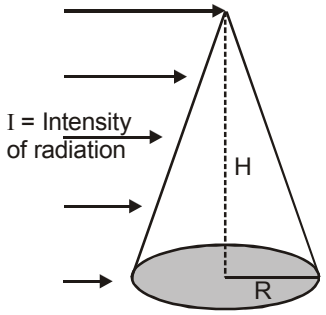
6. If the frequency of K_α X-ray emitted from element with atomic number 31 is f, then the frequency of K_α X-ray emitted from the element with atomic number 51 would be (assume that screening constant for K_α is 1) :

(A) $\frac{5}{3}$ f (B) $\frac{51}{31}$ f (C) $\frac{9}{25}$ f (D) $\frac{25}{9}$ f

7 The radiation force experinced by body exposed to radiation of intensity I, assuming surface of body to be perfectly absorbing is :

(A) $\frac{\pi R^2 I}{c}$ (B) $\frac{\pi RHI}{c}$

(C) $\frac{IRH}{2c}$ (D) $\frac{IRH}{c}$



8 In a photoelectric experiment, with light of wavelength λ, the fastest electron has speed v. If the exciting wavelength is changed to $\frac{3\lambda}{4}$, the speed of the fastest emitted electron will become

(A) $v\sqrt{\frac{3}{4}}$ (B) $v\sqrt{\frac{4}{3}}$ (C) less than $v\sqrt{\frac{3}{4}}$ (D) greater than $v\sqrt{\frac{4}{3}}$

9 In a discharge tube when 200 volt potential difference is applied 6.25×10^{18} electrons move from cathode to anode and 3.125×10^{18} singly charged positive ions move from anode to cathode in one second. Then the power of tube is:

(A) 100 watt (B) 200 watt (C) 300 watt (D) 400 watt

10 Radiation pressure on any surface :

(A) is dependent on wavelength of the light used
(B) is dependent on nature of surface and intensity of light used
(C) is dependent on frequency and nature of surface
(D) depends on the nature of source from which light is coming and on nature of surface on which it is falling.

11 The wavelengths of K_α x-rays of two metals 'A' and 'B' are $\frac{4}{1875\ R}$ and $\frac{1}{675\ R}$ respectively, where 'R' is rydberg constant. The number of elements lying between 'A' and 'B' according to their atomic numbers is

(A) 3 (B) 6 (C) 5 (D) 4

12 An atom consists of three energy levels given by a ground state with energy $E_0 = 0$, the first excited state with energy $E_1 = K$ and the second excited state with energy $E_2 = 2K$ where $K > 0$. The atom is initially in the ground state. Light from a laser which emits photons with energy 1.5K is shined on the atom. Which of the following is/are correct ?

(A) The photons are absorbed, putting one atom in a state E_1 and one atom in a state E_2.
(B) A photon will always be absorbed, but half the time the atom will go into the state with energy K and the other half into the state with energy 2K. In this way, energy will be conserved on the average.
(C) The atom absorbs a phton, goes into the first excited state with energy K and emits a photon with energy 0.5 K to conserve energy.
(D) The atom does not absorb any photon and stays in the ground state.

13 The work function of a certain metal is $\frac{hC}{\lambda_0}$. When a monochromatic light of wavelength $\lambda < \lambda_0$ is incident such that the plate gains a total power P. If the efficiency of photoelectric emission is η% and all the emitted photoelectrons are captured by a hollow conducting sphere of radius R already charged to potential V, then neglecting any interaction between plate and the sphere, expression of potential of the sphere at time t is :

(A) $V + \frac{100\eta\lambda Pe\,t}{4\pi\varepsilon_0 RhC}$ (B) $V + \frac{\eta\lambda Pe\,t}{4\pi\varepsilon_0 RhC}$ (C) V (D) $\frac{\lambda Pe\,t}{4\pi\varepsilon_0 RhC}$

14 According to wave theory of radiation, energy is continuously emitted and energy is propagated in the form of waves. Which of the following is not correct according to wave theory ?

(A) Every radiation irrespective of wavelength will cause photoelectric effect
(B) Maximum kinetic energy of photoelectrons depends on the intensity of radiation
(C) Wave theory predicts appreciable time lag with less intense radiation
(D) Maximum kinetic energy of photo electrons depends on wavelength or frequency of radiation

15 An image of the sun is formed by a lens of focal length 30 cm on the metal surface of a photo-electric cell and it produces a current I. The lens forming the image is then replaced by another lens of the same diameter but of focal length 15 cm. The photoelectric current in this case will be :

(A) I/2 (B) 2 I (C) I (D) 4 I

16 The frequency and the intensity of a beam of light falling on the surface of photoelectric material are increased by a factor of two. This will

(A) increase the maximum kinetic energy of the photoelectrons, as well as photoelectric current by a factor of two

(B) increase the maximum kinetic energy of the photo electrons and would increase the photo electric current by a factor of two

(C) increase the maximum kinetic energy of the photo electrons by a factor of two and will have no effect on the magnitude of the photo electrons by a factor of two and will have no effect on the magnitude of the photoelectric current produced

(D) not produce any effect on the kinetic energy of the emitted electrons but will increase the photo electric current by a factor of two.

17 When a monochromatic source of light is at a distance of 0.2 m from a photoelectric cell, the cut-off voltage and the saturation current are respectively 0.6 V and 18 mA. If the same source is placed 0.6 m away from the cell, then :

(A) the stopping potential will be 0.2 V (B) the stopping potential will be 1.8 V

(C) the saturation current will be 6.0 mA (D) the saturation current will be 2.0 mA

18 The electron in a hydrogen atom makes a transition from an excited state to the ground state. Which of the following statements is true ?

(A) Its kinetic energy increases and its potential and total energies decreases

(B) Its kinetic energy decreases, potential energy increases and its total energy remains the same

(C) Its kinetic and total energies decrease and its potential energy increases

(D) Its kinetic, potential and total energies decrease

19 Which one of the following statements is NOT true for de Broglie waves ?

(A) All atomic particles in motion have waves of a definite wavelength associated with them

(B) The higher the momentum, the longer is the wavelength

(C) The faster the particle, the shorter is the wavelength

(D) For the same velocity, a heavier particle has a shorter wavelength

20 Electrons with energy 80 keV are incident on the tungsten target of an X-ray tube. *K* shell electrons of tungsten have – 71.5 keV energy. X-rays emitted by the tube contain :

(A) A continuous x-ray spectrum (Bremsstrahlung) with a minimum wavelength of about 0.155 Å

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

(C) The characteristic X-ray spectrum of tungsten

(D) A continuous X-ray spectrum (Bremsstrahlung) with a minimum wavelength of about 0.155 Å and the characteristics X-ray spectrum of tungsten

21 X-rays from a given X-ray tube operating under specified conditions have a sharply defined minimum wavelength. The value of this minimum wavelength could be reduced by

(A) increasing the temperature of the filament.

(B) increasing the p.d. between the cathode and the target.

(C) reducing the pressure in the tube.

(D) using a target material of higher relative atomic mass.

22 Two photons having

(A) equal wavelengths have equal linear momenta (B) equal energies have equal linear momenta

(C) equal frequencies have equal linear momenta (D) equal linear momenta have equal wavelengths.

23 A proton, when accelerated through a potential difference of V volts, has a wavelength λ associated with it. If an alpha particle is to have the same wavelength λ, it must be accelerated through a potential difference of :
(A) $V/8$ volts (B) $V/4$ volts (C) 4 V volts (D) 8 V volts

24 Which one of the following statements is NOT true about photoelectric emission ?
(A) For a given emitter illuminated by light of a given frequency, the number of photo-electrons emitted per second is proportional to the intensity of incident light.
(B) For every emitter there is a definite threshold frequency below which no photoelectrons are emitted, no matter what the intensity of light is
(C) Above the threshold frequency, the maximum kinetic energy of photoelectrons is proportional to the frequency of incident light
(D) The saturation value of the photoelectric current is independent of the intensity of incident light

25 When monochromatic light falls on a photosensitive material, the number of photoelectrons emitted per second is n and their maximum kinetic energy is K_{max}. If the intensity of the incident light is doubled keeping the frequency same, then :
(A) both n and K_{max} are doubled (B) both n and K_{max} are halved
(C) n is doubled but K_{max} remains the same (D) K_{max} is doubled but n remains the same

26 An X-ray photon of wavelength λ and frequency ν collides with an initialy stationary electron (but free to move) and bounces off. If λ' and ν' are respectively the wavelength and frequency of the scattered photon, then :
(A) $\lambda' = \lambda; \nu' = \nu$ (B) $\lambda' < \lambda; \nu' > \nu$ (C) $\lambda' > \lambda; \nu' > \nu$ (D) $\lambda' > \lambda; \nu' < \nu$

27 The frequency and intensity of a light source are both doubled. Consider the following statements.
(i) The saturation photocurrent remains almost the same.
(ii) The maximum kinetic energy of the photoelectrons is doubled.
(A) Both (i) and (ii) are true (B) (i) is true but (ii) is false
(C) (i) is false but (ii) is true (D) both (i) and (ii) are false

28 In Millikan's oil drop experiment, a charged oil drop of mass 3.2×10^{-14} kg is held stationary between two parallel plates 6 mm apart by applying a potential difference of 1200 V between them. How many excess electrons does the oil drop carry ? Take $g = 10\ ms^{-2}$:
(A) 7 (B) 8 (C) 9 (D) 10

29 In Millikan's oil drop experiment, an oil drop carrying a charge q falls with a terminal velocity v_0 when there is no electric field between the plates. An electric field E is applied to keep it stationary. What additional charge should the oil drop acquire so that it begins to move upwards with a velocity $2v_0$ in the same electric field ?
(A) q (B) 2 q (C) 3 q (D) 4 q

30 A caesium photo cell, with a steady potential difference of 60 volt across it, is illuminated by a small bright light placed 50 cm away. When the same light is placed one meter away the electrons crossing the photo cell :
(A) each carry one quarter of their previous energy (B) each carry one quarter of their previous momentum
(C) are half as numerous (D) are one quarter as numerous

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	B	D	A	D	A	D	D	D	C	B
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	D	D	B	D	C	B	D	A	B	D
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	B	D	A	D	C	D	B	D	B	D