Electron, Photon and X-ray Assignment

1. When the speed of electrons increases, then the value of its specific charge

(a) Increases (b) Decreases

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

2. 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

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

3. Cathode rays are similar to visible light rays in that

(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

4. 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

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

5. The cathode rays have particle nature because of the fact that

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

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

6. When cathode rays (tube voltage ~ 10 *kV*) collide with the anode of high atomic weight then we get

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

7. To produce positive rays the pressure in a discharge tube should be

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

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

8. Wavelength associated with an electron of kinetic energy 54 *eV* is

(a) $1.66\times10^{-10}\,m$ (b) $2.6\times10^{-9}\,m$ (c) $3.5\times10^{-11}\,m$ (d) None of the above

9. The energy that should be added to an electron to reduce its de-Broglie wavelengths from 10^{-10} *m* to $0.5\times10^{-10}\,m$ will be

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

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

10. 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

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

11. 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

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

12. The de-Brogile wavelength of electron is 10Å, then its velocity in *m/sec* will be

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

13. 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

(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

14. The energy of incident photons corresponding to maximum wavelength of visible light is

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

15. 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*

16. Threshold wavelength for metal is 5200 Å. The photoelectrons will be ejected if it is irradiated by light from

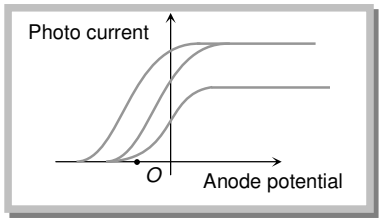
(a) 50 watt infrared lamp (b) 1 watt infrared lamp (c) 50 watt ultraviolet lamp (d) 0.5 watt infrared lamp

17. The dual nature of light is exhibited by

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

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

18. 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.



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

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

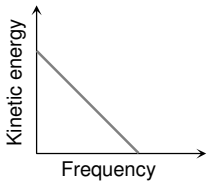
(c) $f_a = f_b$ and $I_a = I_b$

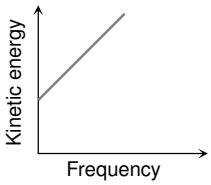
(d) $f_a = f_b$ and $I_b = I_c$

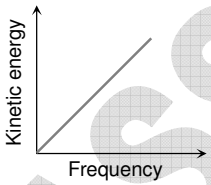
19. A photon of energy 4 *eV* is incident on a metal surface whose work function is 2 *eV*. The minimum reverse potential to be applied for stopping the emission of electrons is

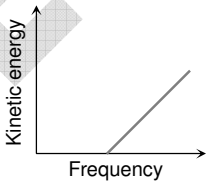
(a) 2 *V* (b) 4 *V* (c) 6 *V* (d) 8 *V*

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

(a) 

(b) 

(c) 

(d) 

21. 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

(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

22. 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

(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) $\frac{n_1}{n_2} = \frac{\gamma_1^2}{\gamma_2^2}$

23. 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

(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

24. 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

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

25. 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

26. *X*-ray will travel minimum distance in

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

27. 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*

28. Characteristic *X*-rays are produced due to

(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

29. *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

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

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

31. 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

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

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

33. *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

34. 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

35. *X*-ray beam can be deflected by

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

36. 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 $n = 1$

37. 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

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

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

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

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

40. Bragg's law for X-rays is

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

41. Intensity of *X*-rays depends upon the number of

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

42. 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*

43. 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 $n = 2$

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

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

45. 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

(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 $h\nu_0$

46. 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*

47. The eye can detect $5\times10^4\,\text{Photons}/m^2-\text{sec}$ of green light $(\lambda = 5000\,\text{Å})$, 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}

48. When light of intensity 1 W/m^2 and wave length 5×10^{-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 $1cm^2$, then the photoelectric current will be

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

49. 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

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

50. 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

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