MODERN PHYSICS

1. The work function of a substance is 3.1 eV. The longest wavelength of light that can cause photoelectron emission from the substance is approximately
(a) 540 nm (b) 400 nm
(c) 310 nm (d) 220 nm

2. When the intensity of a light source is increased
(a) more energetic photons are emitted
(b) faster photons are emitted
(c) the total energy of the photo electrons emitted per unit time increase
(d) the number of photons emitted by the source in unit time increase

3. The work function of a metal is 1.5 eV. Light of wavelength 6000 Å is made incident on it. The maximum K.E. of emitted photoelectrons will b e
(a) 0.6×10^{-18} J (b) 0.6×10^{-19} J
(c) 1.6×10^{-19} J (d) 1.6 eV

4. The photoelectric current in an experiment on photoelectric effect increases if
(a) the exposure time is decreased
(b) the exprosure time is increased
(c) the intensity of the source is increased
(d) the intensity of the source is decreased

5. The threshold wavelength for photoelectric emission from a material is 6000 Å. Photoelectrons will be emitted when this material is illuminated with monochromatic radiation from a
(a) 10 watt infrared lamp
(b) 10 watt ultraviolet lamp
(c) 500 watt infrared lamp
(d) 5000 watt ultraviolet lamp

6. The wavelength of an electron moving with a velocity of 5000 km s^{-1} is (take $m_e = 9 \times 10^{-31}$ kg and $h = 6.6 \times 10^{-34}$ Js)
(a) 1.45 nm (b) 0.5 nm
(c) 2.9 nm (d) 3.0 nm

7. If the energy of a photon corresponding to a wavelength of 6000 Å is 3.32×10^{-19} J; the photon energy for a wavelength of 4000 Å will be
(a) 4.98×10^{-19} J (b) 4.44×10^{-19} J
(c) 2.22×10^{-19}J (d) 1.11×10^{-19} J

8. The energy of photon corresponding to the visible light of maximum wavelength is approximately
(a) 1 eV (b) 1.6 eV
(c) 3.2 eV (d) 7 eV

9. The work function of a photoelectric material is 3.3 eV. The threshold frequency will be equal to
(a) 8×10^{10} Hz (b) 4×10^{14} Hz
(c) 8×10^{14} Hz (d) 4×10^{20} Hz

10. For light of wavelength 5000 Å, the photon energy is nearly 2.5 V. For X-rays of wavelength 1 Å, the photon energy will be close to
(a) $2.5 \div 5000$ eV (b) $2.5 \div (5000)^2$ eV
(c) 2.5×5000 eV (d) $2.5 \times (5000)^2$ eV

11. In order to increase the kinetic energy of ejected photoelectron, there should be an increase in
(a) intensity of radiation
(b) wavelength of radiation
(c) frequency of radiation
(d) both the wavelength and intensity of radiation

12. In an electron gun, the control grid is given a negative potential relative to the cathode in order to
(a) decelerate the electron
(b) decreases the K.E. of the electron
(c) select the electrons of the same velocity and to converge them along the axis
(d) repel the electrons and thus to control the number of electrons passing through it

13. The threshold wavelength for photoelectric effect of a metal is 6500 Å. The work function of the metal is approximately.
(a) 2 eV (b) 1 eV
(c) 0.1 eV (d) 3 eV

14. Number of ejected photoelectrons increases with increase
(a) in intensity of light
(b) in wavelength of light
(c) in frequency of light
(d) never

15. Ultraviolet light of 6.2 eV falls on an aluminum surface. If work function = 4.2 eV, then the maximum kinetic energy of electron emitted is
(a) 3.2×10^{-19} joule (b) 3.2×10^{-20} joule
(c) 9×10^{-10} joule (d) 7×10^{-19} joule

16. Photoelectric effect is due to
(a) wave nature of light
(b) particle nature of light
(c) both (a) and (b)
(d) none of these

17. In photoelectric effect, the photoelectric current
(a) increases when frequency of incident photons increases
(b) decreases when frequency of incident photons increases
(c) does not depend on photon frequency but only on intensity of incident beam
(d) depends both on intensity and frequency of incident beam

18. The threshold frequency of a certain metal is 3.3×10^{14} Hz. If light of frequency 8.2×10^{14} Hz is incident on the metal, predict the cut off voltage for photoelectric emission. Given Planck's constant, $h = 6.62 \times 10^{-34}$ Js.
(a) 202.74 V (b) 205.75 V
(c) 202.67 V (d) None of these

19. The work function of caesium metal is 2.14 eV. When light of frequency 6×10^{14} Hz is incident on the metal surface, photoemission of electrons occurs. What is the maximum kinetic energy of the emitted electrons.
(a) 0.45 eV (b) 0.34 eV
(c) 0.75 eV (d) None of these

20. Light of frequency 7.21×10^{14} Hz is incident on a metal surface. Electrons with a maximum speed of 6.0×10^{5} ms^{-1} are ejected from the surface. What is the threshold frequency for photoemission of electrons?

$h = 6.63 \times 10^{-34}$ Js, $m_e = 9.1 \times 10^{-31}$ kg.

(a) 5.54×10^{14} Hz (b) 5.56×10^{14} Hz

(c) 4.74×10^{14} Hz (d) None of these

21. Find the difference of kinetic energies of photoelectrons emitted from a surface by light of wavelength 2500 Å and 5000 Å. [$h = 6.62 \times 10^{-34}$ Js]

(a) 3.87×10^{-19} J (b) 3.96×10^{-19} J

(c) 4.48×10^{-19} J (d) None of these

22. Calculate the maximum kinetic energy of electrons emitted from a photosensitive surface of work function 3.2 eV, for the incident radiation of wavelength 300 nm. Given: $h = 6.6 \times 10^{-34}$ Js

(a) 0.925 eV (b) 0.435 eV

(c) 0.897 eV (d) None of these

23. The light of energy 1 eV and 3 eV respectively are made incident on a metallic plate of work function 0.5 eV one after the other. Find the ratio of maximum kinetic energy of photoelectrons emitted by them.

(a) 1.5 (b) 1.7

(c) 2.3 (d) 2.5

24. Ultra-violet light of wavelength 800 Å and 700 Å when allowed to fall on hydrogen atoms in their ground state is found to liberate electrons with K.E., 1.8 eV and 4.0 eV respectively. Find the value of Planck's constant.

(a) 6.57×10^{-34} Js (b) 7.57×10^{-24} Js

(c) 6.57×12^{-34} Js (d) None of these

25. A metal has threshold wavelength of 6000 Å. Calculate threshold frequency. Given:

$h = 6.62 \times 10^{-34}$ Js; $e = 1.6 \times 10^{-19}$ C.

(a) 5×10^{14} Hz, 2.07 eV (b) 6×10^{14} Hz, 2.07 eV

(c) 4.5×10^{12} Hz, 2.08 eV (d) None of these

26. The mass of an electron in notion depends upon:

(a) direction of motion (b) its velocity

(c) initial mass of e^- (d) its shell number

27. The mass and energy equivalent to 1 amu respectively are:

(a) 1.67×10^{-27} g, 9.30 MeV

(b) 1.67×10^{-27} kg, 930 MeV

(c) 1.67×10^{-27} kg, 1 MeV

(d) 1.67×10^{-34} kg, 1 MeV

28. The acceleration of electron in the first orbit of hydrogen atom is:

(a) $\frac{4\pi^2 m}{h^3}$ (b) $\frac{h^2}{4\pi^2 mr}$

(c) $\frac{h^2}{4\pi^2 m^2 r^3}$ (d) $\frac{m^2 h^2}{4\pi^2 r^3}$

29. If the electron in a hydrogen atom jumps from an orbit level $n_1 = 3$ to an orbit level $n_2 = 2$, the emitted radiation has a wavelength given by:

(a) $\lambda = \frac{36}{5R}$ (b) $\lambda = \frac{5R}{36}$

(c) $\lambda = \frac{6}{R}$ (d) $\lambda = \frac{R}{6}$

30. The angular momentum of electron in hydrogen atom is proportional to:

(a) $\sqrt{r}$ (b) $\frac{1}{r}$

(c) r^2 (d) $\frac{1}{\sqrt{r}}$

31. The radius of hydrogen atom, when it is in its second excited state, becomes:

(a) half (b) double

(c) four times (d) nine times

32. In terms of Rydberg's constant R, the wave number of the first Balmer line is:

(a) R (b) 3R

(c) $\frac{5R}{36}$ (d) $\frac{5R}{9}$

33. For electron moving in nth orbit of the atom, the angular velocity is proportional to:

(a) n (b) $\frac{1}{n}$

(c) n^3 (d) $\frac{1}{n^3}$

34. The velocity of an electron in its first orbit, if the velocity of an electron in the second orbit of sodium atom (atomic number = 11) is v, will be:

(a) v (b) $\frac{22}{5}v$

(c) $\frac{5}{2}v$ (d) $\frac{2}{5}v$

35. Atomic hydrogen is excited to the nth energy level. The maximum number of spectral lines which it can emit while returning to the ground state, is:

(a) $\frac{1}{2}n(n-1)$ (b) $\frac{1}{2}n(n+1)$

(c) $n(n+1)$ (d) $n(n+1)$

36. If KE of the electron in an orbit of radius r in hydrogen atom is : (e = electronic charge)

(a) $\frac{e^2}{r^2}$ (b) $\frac{e^2}{2r}$

(c) $\frac{e^2}{r}$ (d) $\frac{e^2}{2r^2}$

37. If 13.6 eV energy is required to ionize the hydrogen atom then the energy required to remove an electron from n = 2 is:

(a) 10.2 eV (b) zero

(c) 3.4 eV (d) 6.8 eV

38. The wavelengths involves in the spectrum of deuterium (^2_1D) are slightly different from that of hydrogen spectrum, because:

(a) seizes of the two nuclei are different

(b) nuclear forces are different in the two cases

(c) masses of the two nuclei are different

(d) attraction between the electron and the nucleus is

different in the two cases

39. α-particles are projected towards the nuclei of the following metals, with the same kinetic energy. Towards which metal, the distance of closest approach is minimum?

(a) Cu (Z = 29) (b) Ag (Z = 47)

(c) Au (Z = 79) (d) Pd (Z = 46)

40. An α-particle accelerated through V volt is fired towards a nucleus. Its distance of closest approach is r. If a proton accelerated through the same potential is fired towards the same nucleus, the distance of closest approach of proton will be:

(a) r (b) 2r

(c) r/2 (d) r/4

41. The distance of closest approach of an α-particle fired towards a nucleus with momentum p, is r. What will be the distance of closest approach when the momentum of α-particle is 2p?

(a) 2r (b) 4r

(c) r/2 (d) r/4

42. Which of the following is incorrect regarding Rutherford's atomic model?

(a) Atom contains nucleus

(b) Size of nucleus is very small in comparison to that of

atom

(c) Nucleus contains about 90% mass of the atom

(d) Electrons revolve round the nucleus with uniform

speed

43. The equivalent current due to motion of electron in first orbit of H-atom is:

(a) 0.7×10^{-3} A (b) 9×10^{-3} A

(c) 10^{-3} A (d) None of these

44. If the radius of first Bohr's orbit is x, then de-Broglie wavelength of electron in 3rd orbit is nearly:

(a) $2\pi x$ (b) $6\pi x$

(c) 9x (d) x/3

45. Rydberg atoms are the hydrogen atoms in higher excited states. Such atoms are observed in space. The orbit number for such an atom with radius about 0.01 mm should be:

(a) 1 (b) 435

(c) 13749 (d) 117

46. In one revolution round the hydrogen nucleus, an electron makes five crests. The electron should belong from:

(a) 1st orbit (b) 4th orbit

(c) 5th orbit (d) 6th orbit

47. The circumference of the second orbit of an atom or ion having single electron, is 4×10^{-9} m. The de-Broglie wavelength of electron revolving in this orbit should be:

(a) 2×10^{-9} m (b) 4×10^{-9} m

(c) 8×10^{-9} m (d) 1×10^{-9} m

48. In each of the following atoms or ions, electronic transition from n = 4 to n = 1 takes place. The frequency of the radiation emitted out will be minimum for:

(a) hydrogen atom (b) deuterium atom

(c) He^+ ion (d) Li^{2+} ion

49. If an electron is revolving round the hydrogen nucleus at a distance of 0.1 nm, what should be its speed?

(a) 2.188×10^6 m/s (b) 1.094×10^6 m/s

(c) 4.376×10^6 m/s (d) 1.59×10^6 m/s

50. The angular momentum of the electron in third orbit of hydrogen atom, if the angular momentum in the second orbit of hydrogen atom is L is:

(a) L (b) 3L

(c) $\frac{3}{2}$L (d) $\frac{2}{3}$L

ANSWERS KEY

1	A	**11**	C	**21**	B	**31**	D	**41**	D
2	B	**12**	D	**22**	A	**32**	C	**42**	C
3	B	**13**	A	**23**	A	**33**	D	**43**	C
4	C	**14**	A	**24**	A	**34**	D	**44**	B
5	A,D	**15**	A	**25**	A	**35**	A	**45**	B
6	A	**16**	C	**26**	B	**36**	B	**46**	C
7	A	**17**	C	**27**	B	**37**	C	**47**	A
8	B	**18**	A	**28**	C	**38**	C	**48**	A
9	C	**19**	B	**29**	A	**39**	A	**49**	D
10	C	**20**	C	**30**	A	**40**	A	**50**	C