CLASS XII

CHAPTER 11, 12 and 13 Dual nature of radiation, Atoms and Nuclei

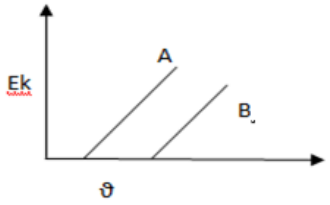
---

SECTION A CONCEPTUAL AND APPLICATION TYPE QUESTIONS

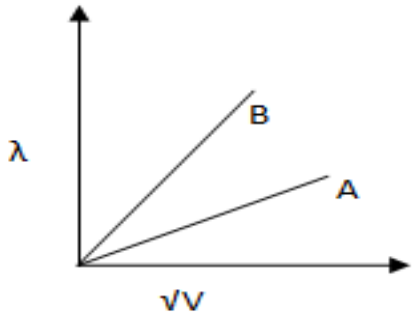
1	What is the stopping potential applied to a a photocell if the maximum kinetic energy of a photoelectron is 5eV ?	1
2	Work functions of two metals A and B are 4eV and 10 eV respectively . Which metal has the higher threshold wavelength ?	1
3	Two beams ,one of red light and the other of blue light , of same intrensity incident on a metallic surface to emit Photoelectrons. Which one of them emits electrons of greater kinetic energy?	1
4	How does the stopping potential of a Photo cell change ,when i) the intensity of the incident radiation is halved? Ii) frequency of incident radiation increases ?	
5	If the potential difference used to accelerate electrons is tripled , by what factor the de Broglie wavelength of electron beam change?	1
6	An electron and proton have the same kinetic energy .Which one of them has the larger de Broglie wavelength.	1
7	An alpha particle and a proton are accelerated from rest by the same potential. Find the ratio of their de Broglie wavelengths.	2
8	Show graphically the variation of de Broglie wavelength λ of an electron with i)$\sqrt{V}$ ii) V where V is the potential through which an electron is accelerated from rest.	2
9	Name the experiment which verified the wave nature of electrons. Which phenomenon was observed in this experiment using an electron beam?	2
10	Why Caesium oxide is coated on the cathode of Photo electric cell?	1

11 Why is the penetrating power of gamma rays more than that of beta and alpha radiations? 1

12 The figure shows plot of Kinetic energy of photoelectrons emitted with the frequency of incident radiation for two photosensitive materials A and B . 1(repeated)
i) Which of them has more threshold wavelength ?
ii) Which of them has more work function?
iii) From which electrons will be emitted with more kinetic energy?



13 Two lines A and B in the plot given below show the variation of de Broglie wavelength λ versus √V, 2
Where V is the accelerating potential difference, for two particles carrying the same charge. Which of the two represents a particle of small mass?



14 1
Are matter waves electromagnetic in nature ?
What is the rest mass of a Photon?

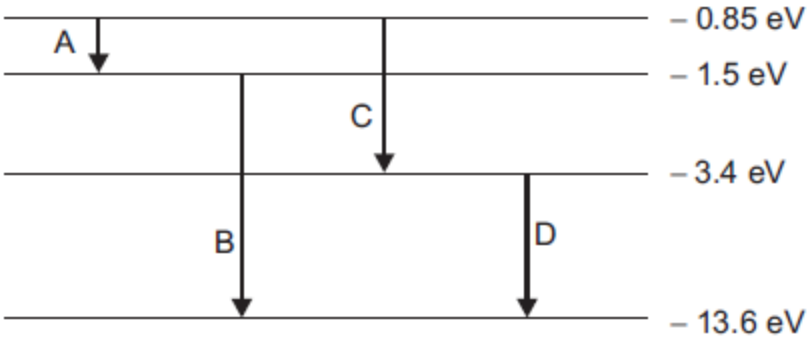
15 What is the role of a moderator in a nuclear reactor? Explain its working .Mention the substance used as a moderator. 2

16 How do the neutron to Proton Ratio change during 2
i) β^+ ii) β^- iii) α emission?

17	Name the particle which is emitted along with i) β^- particle ii) β^+ particle . Why is it difficult to detect these particles ?	1(2006 S)
18	Define nuclear density and show that nuclear density does not depend on the mass and size of the nucleus.	2
19	Compare the nuclear radius ,volume ,and nuclear density of $_4Be^8$ and $_{13}Al^{27}$	3
20	With a neat labeled diagram explain the experiment which verified the existence of Matter Waves.	(2015)
21	Draw a graph between the potential energy of two nucleons as a function of separation between them mark the limit for attractive and repulsive forces.	(2015)
22	Define K factor or Multiplication factor.	1

SECTION B NUMERICAL PROBLEMS

1	A metallic surface when illuminated with light of wavelength 3333 Å emits electrons with energies upto 0.6 eV. Calculate the work function of the metal.	3(2008)
2	Calculate the threshold frequency of photons which can remove photoelectrons from (i) caesium and (ii) nickel surface (work function of Caesium is 1.8 eV and work function of nickel is 5.9 eV	3
3	The work function of zinc is 6.8×10^{-19} J. What is the threshold frequency for emission of photoelectrons from zinc?	2)
4	Calculate the de Broglie wave length of an electron, if the speed is 105 ms−1. (Given m = 9.1×10^{-31} kg; h = 6.626×10^{-34} Js)	
5	In the Bohr model of hydrogen atom, what is the de Broglie wave length λ for the electron when it is in the (i) n = 1 level and (ii) n = 4 level. In each case, compare the de Broglie wave length to the circumference of the orbit.	2
6	Red light of wavelength 670 nm produces photoelectrons from a certain metal which requires a stopping potential of 0.5 V. What is the work function and threshold wavelength of the metal?.	3
7	The half-life of 84Po218 is 3 minute. What percentage of the sample has decayed in 15 minutes?	
8	Calculate the binding energy and binding energy per nucleon of 20Ca40 nucleus. Given, mass of 1 proton = 1.007825 amu ; mass of 1 neutron = 1.008665 amu ; mass of 20Ca40 nucleus = 39.96259 amu	2

9	Find the energy released when two $_1H^2$ nuclei fuse together to form a single $_2He^4$ nucleus. Given, the binding energy per nucleon of $_1H^2$ and $_2He^4$ are 1.1 MeV and 7.0 MeV respectively.	2 (2010)
10	The work function of Iron is 4.7 eV. Calculate the cut off frequency and the corresponding cut off wave length for this metal.	2
11	The disintegration constant λ of a radioactive element is 0.00231 per day. Calculate its half life and mean life.	2(1992, 1998)
12	The half life of radon is 3.8 days. Calculate its mean life.	2
13	The radioactive isotope $_{84}Po^{214}$ undergoes a successive disintegration of two α–decays and two β-decays. Find the atomic number and mass number of the resulting isotope	2
14	An electromagnetic wave of wavelength λ is incident on a photosensitive surface of negligible work function. If the Photo electrons emitted from the surface have De-Broglie wavelength λ_1 prove that $\lambda = (2mC/h)\lambda_1^2$	3
15	The de-Broglie wavelength of a photon is same as the wavelength of an electron. Show that the kinetic energy of photon is 2 λmC/h times the kinetic energy of electron,where m is the mass of electron and C is the speed of light	2
16	The energy levels of an element are given below:  Identify, using necessary calculations, the transition, which corresponds to the emission of a spectral line of wavelength 482 nm	