Atomic structure
practice sheet

Q1. In the Rutherford scattering experiment, the number of alpha particles scattered at an angle $\theta = 60°$ is 36 per minute. The number of alpha particles per minute scattered at angles $\theta = 90°$ is (Assume all other conditions to be identical.)

(a) 144 (b) 9
(c) 36 (d) 16

Q2. If nucleus and atom are considered as perfect spheres with the diameters 4×10^{-15} m and 2×10^{-10} m, respectively, then the ratio of the volumes of nucleus and atom should be

(a) 2×10^{-5}:1 (b) 8×10^{-15}:1
(c) 1.25×10^{14}:1 (d) 8×10^{15}:1

Q3. An α-particle accelerated through V volt is fired towards a nucleus. It 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 the proton will be

(a) r (b) $2r$
(c) $r/2$ (d) $r/4$

Q4. 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 the α-particle is 2P?

(a) $2r$ (b) $4r$
(c) $r/2$ (d) $r/4$

Q5. A photo sensitive surface is receiving light of wavelength 5000 Å at the rate of 10^{-7} J/s. The number of photons received per second is

(a) 2.5×10^{11} (b) 3.0×10^{32}
(c) 2.5×10^{18} (d) 2.5×10^{9}

Q6 A dye emits 50% of the absorbed energy as fluorescence. If the number of quanta absorbed and emitted out is in the ratio 1:2 and it absorbs the radiation of wavelength 'x' Å, then the wavelength of the emitted radiation will be

(a) x Å (b) $0.5\,x$ Å
(c) $4x$ Å (d) $0.25\,x$ Å

Q7 An electron at rest is accelerated through a potential difference of 200 V. If the specific charge of electron is 1.76×10^{11} C/kg, the speed acquired by the electron is about

(a) 8.4×10^{6} cm/s
(b) 8.4×10^{6} m/s
(c) 4.2×10^{6} m/s
(d) 4.2×10^{6} cm/s

Q8 An electron and a proton are accelerated through a potential V. If P_e and P_p are their momentum, then P_p:P_e ratio is approximately equal to

(a) 1:1836 (b) 1:1
(c) 1836:1 (d) 43:1

Q9

An amount of 1.75×10^{-4} mole of HI decomposes by the absorption of photons of wavelength 2500 Å. If one molecule is decomposed per absorbed photon, the total energy absorbed is ($N_A \times hc = 0.12$)

(a) 42.0 J
(b) 4.2 J
(c) 8.4 J
(d) 84 J

Q10

At one time the meter was defined as 1650763.73 wavelength of the orange light emitted by a light source containing Kr^{86} atoms. What is the corresponding photon energy of this radiation?

(a) 3.28×10^{-19} J/quanta
(b) 1.2×10^{-31} J/quanta
(c) 1.09×10^{-27} J/quanta
(d) 2.048 J/quanta

Q11

A ruby laser produces radiations of wavelength 662.6 nm in pulses whose duration are 1.0×10^{-9} s. If the laser produces 0.36 J of energy per pulse, how many photons are produced in each pulse?

(a) 1.2×10^{9}
(b) 1.2×10^{27}
(c) 1.2×10^{18}
(d) 1.2×10^{15}

Q12

. Photons of frequency, ν, fall on metal surface for which the threshold of frequency is v_0. Then

(a) All ejected electrons have the same kinetic energy, $h(v - v_0)$.
(b) The ejected electrons have a distribution of kinetic energy from zero to $h(v - v_0)$.
(c) The most energetic electron has kinetic energy hv.
(d) The average kinetic energy of ejected electrons is $h(v - v_0)$.