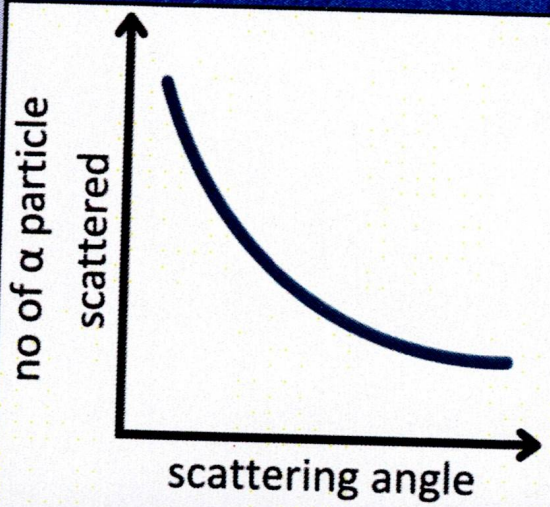
ATOM

Rutherford Gold Foil Experiment



Application

Closest distance of approach

$$r_o = \frac{2KZe^2}{E}$$

Impact Parameter

$$\cot\frac{\theta}{2} = \frac{2b}{r_o}$$

Bohr Atomic Model

Force	$F_e = \frac{mv^2}{r}$	$\frac{KZe^2}{r^2} = \frac{mv}{r}$
Angular Momentum	$L = mvr$	$mvr = \frac{nh}{2\pi}$
Energy of electron	$h\nu = \lvert E_i - E_f \rvert$	

Important Results		
Radius of n^{th} orbit	$r_n = \frac{r_o n^2}{Z}$	
Velocity of n^{th} orbit	$v_n = \frac{v_o Z}{n}$	
Energy of n^{th} orbit	$E_n = -13.6 \frac{Z^2}{n^2}$	
Time Period	$T \propto \frac{n^3}{Z^2}$	$T = \frac{2\pi r_n}{v_n}$
Frequency of n^{th} orbit	$v \propto \frac{1}{T} \propto \frac{Z^2}{n^3}$	
Current in n^{th} orbit	$I \propto \frac{Z^2}{n^3}$	
Magnetic field	$B = \frac{\mu_o I_n}{2r_n}$	
Magnetic Moment	$M \propto \frac{Z}{n}$	
Area	$A \propto \frac{n^4}{Z^2}$	
Spectral Series	$\frac{1}{\lambda} = RZ^2\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$	

NUCLEI

Important Points

Size of Nucleus	$R = R_o A^{1/3}$
Volume of Nucleus	$V = \frac{4}{3}\pi R_o^3 A$
Density of Nucleus	$D = \frac{\mu}{\frac{4}{3}\pi R_o^3}$
Mass Defect	$\Delta m = [Zm_p + (A-Z)m_n] - M$
Binding energy	$B.E. = \{[Zm_p + (A-Z)m_n] - M\}c^2$
Binding Energy per Nucleon	$\frac{B.E.}{A} = \frac{\{[Zm_p + (A-Z)m_n] - M\}c^2}{A}$
Nuclear Stability	$\frac{N}{Z} > 1.51$
Q value of Nuclear Rxn	$Q = (m_R - m_P)c^2$
Nuclear Force	$F_a \propto \frac{1}{r^7}$ $F_r = \frac{1}{r^9}$

Radioactivity

Rate of Disintegration	$-\frac{dN}{dt} = \lambda dt$
No. of nuclei present undecayed at any instant	$N = N_o e^{-\lambda t}$
Half life	$t_{1/2} = \frac{0.693}{\lambda}$
Mean Life/Average Life	$\frac{N}{N_o} = \left(\frac{1}{2}\right)^{t/t_{1/2}}$

Types of Decay

Alpha Decay	${}^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}X + {}^{4}_{2}He$ $Q = [m_X - (m_Y + m_{He})]c^2$

Beta Decay

Minus β decay	Plus β decay
${}^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}X + {}^{0}_{-1}e + \bar{\nu}$ $\Delta\epsilon = (M_X - M_Y)c^2$	${}^{A}_{Z}X \longrightarrow {}^{A}_{Z-1}X + {}^{0}_{+1}e^{+} + \bar{\nu}$ $\Delta\epsilon = (M_X - M_Y - 2me)c^2$
Gamma Decay	${}^{A}_{Z}X \longrightarrow {}^{A}_{Z}Y + \gamma$ rays