**FIGURE CAPTIONS**

Fig. 2.1 Energy level diagram and possible transitions.

Fig. 2.2 Schematic diagram showing the emission of characteristic K X-rays and Auger electrons.

Fig. 2.3 The three geometry categories for radioisotope excited fluorescence spectrometers (a) Annular source (b) Central source and (c) Side source.

Fig. 3.1 Sample, Excitor and detector geometry setup (a) Direct fluorescence mode (b) Secondary fluorescence mode.

Fig. 3.2 Configuration of various radioisotopes (a) 241Am (b) 109Cd (c) 55Fe.

Fig. 3.3 Block diagram of the X-rays detection system.

Fig. 3.4 (a) Background spectrum of mylar foil with 109Cd exciter for extended geometry.

Fig. 3.4 (b) Background spectrum of mylar foil with 109Cd exciter for 7 mm collimator.
Fig. 3.4 (c) Background spectrum of mylar foil with $^{109}\text{Cd}$ exciter for 4 mm $\phi$ collimator.

Fig. 3.4 (d) Background spectrum of mylar foil with $^{109}\text{Cd}$ exciter for 2 mm $\phi$ collimator.

Fig. 3.5 (a) Relative efficiency curve for 6 mm $\phi \times 5.2$ mm Si(Li) detector using radioisotopes and metallic foils for the geometry used in actual experiments.

Fig. 3.5 (b) Relative efficiency curves to check the effect of collimation on the shape of efficiency curve using the collimators of 7, 4 and 2 mm diameter along the axis of the detector.

Fig. 3.6 Block diagram of the sample preparation unit by drying sample solution on rotating substrate.

Fig. 3.7 Schematic diagram for the derivation of the fluorescent X-ray intensity.

Fig. 4.1 X-ray spectrum of Cu foil (129 $\mu$g/cm$^2$) with $^{109}\text{Cd}$ exciter.

Fig. 4.2 (a) Comparison of measured and theoretically calculated values of $K_{\alpha}$ XRF cross-sections for elements with $20 \leq Z \leq 56$ as a function of energy.
Fig. 4.2 (b) Comparison of measured and theoretically calculated values of K XRF cross-sections for elements with $20 \leq Z \leq 56$ as a function of energy.

Fig. 5.1 (a) Typical L X-ray spectrum of Ho with $^{109}$Cd excitor.

Fig. 5.1 (b) L X-ray spectrum of Ta with $^{3}$n exciter.

Fig. 5.1 (c) L X-ray spectrum of Bi with $^{3}$n exciter.

Fig. 5.2 Comparison of measured and theoretically calculated values of $L_\alpha$ and $L_\beta$ XRF cross-sections for Er, Ta, Au and Bi as a function of energy.

Fig. 5.3 Comparison of measured and theoretically calculated values of $L_\gamma$ and $L_\delta$ XRF cross-sections for Er, Ta, Au and Bi as a function of energy.

Fig. 5.4 Comparison of measured and theoretically calculated values of $L_\alpha$ and $L_\delta$ XRF cross-sections for Ho, Yb, W and Tl as a function of energy.

Fig. 5.5 Comparison of measured and theoretically calculated values of $L_\alpha$ and $L_\delta$ XRF cross-sections for Ho, Yb, W and Tl as a function of energy.
Fig. 5.6 Comparison of measured and theoretically calculated values of L XRF cross-sections at 15.20, 17.80 and 22.60 keV excitation energies as a function of atomic number.

Fig. 5.7 Comparison of measured and theoretically calculated values of L XRF cross-sections at 25.80 and 41.00 keV excitation energies as a function of atomic number.

Fig. 5.8 Comparison of measured and theoretically calculated values of L X-ray relative intensities for Ho, Er, and Yb as a function of energy.

Fig. 5.9 Comparison of measured and theoretically calculated values of L X-ray relative intensities for Tr, W, and Au as a function of energy.

Fig. 5.10 Comparison of measured and theoretically calculated values of L X-ray relative intensities for Tl, Pb, and Bi as a function of energy.

Fig. 6.1 XRF spectrum of geological standard (AGV) (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.2 XRF spectrum of geological standard (PCC) (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.3 XRF spectrum of NBS standard sample refined coal (diluted in cellulose) with $^{109}$Cd exciter.
Fig. 6.4 XRF spectrum of NBS standard sample spinach (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.5 XRF spectrum of NBS standard Bovine liver (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.6 XRF spectrum of cellulose blank with $^{109}$Cd exciter. $W_{L\alpha}$ and $L_{B\alpha}$ peaks are from the exciter.

Fig. 6.7 XRF spectrum of recent bone (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.8 XRF spectrum of Middle Paleocene (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.9 XRF spectrum of Middle miocene (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.10 XRF spectrum of Oligocene (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.11 XRF spectrum of Eocene (diluted in cellulose) with $^{109}$Cd exciter.

Fig. 6.12 XRF spectrum of cretaceous (diluted in cellulose) with $^{109}$Cd exciter.