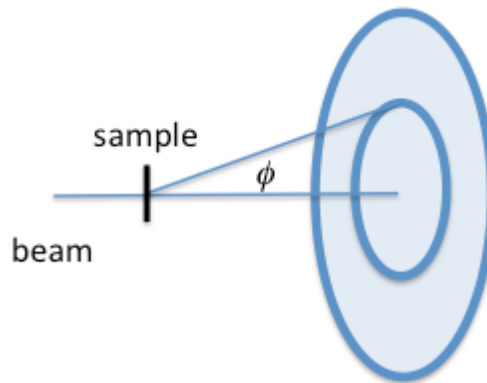


Quantum Mechanics 1 – Problem 7

A beam of electrons with a kinetic energy of 50 eV is incident upon a powdered crystal sample as shown in the sketch below. A series of bright and dark rings is observed on a screen behind the sample.

[The mass of the electron is 9.109×10^{-31} kg.]



- Calculate the de Broglie wavelength of the incident electrons. [2 marks]
- Draw a sketch to illustrate how the scattering angle, ϕ , is related to the Bragg angle, θ . [2 marks]
- Hence, write down an expression for the spacing of the planes of the crystal as a function of the scattering angle, ϕ . [2 marks]
- If bright rings are observed at angles of $\phi = 20^\circ$ and 40.7° to the beam direction, calculate the spacing of the planes of the crystal. [3 marks]
- What photon energy would be required to produce the same diffraction pattern? [1 mark]