

QM4226
QUANTUM THEORY &
HOMEWORK PROBLEMS 5

These questions form part of the continuous assessment of the course. To be
handed in by ...

1. Given the scattering amplitude:

$$f(\theta, \phi) = \frac{1}{k} \sum_l (2l + 1) \sin \delta_l \exp i\delta_l P_l(\cos \theta),$$

Show that for low energies,
 $\sigma \simeq \frac{4\pi}{k^2} \sin^2 \delta_0$, explaining all symbols and assumptions.

2. An experiment measures the distribution of scattered particles, obtaining a differential cross-section: $\frac{\delta\sigma}{\delta\Omega} = \frac{1}{k^2} [a + b \cos \theta + c \cos^2 \theta]$.

Look up the form of the Legendre polynomials, for $l = 0, 1, 2, 3$ in a book/from the Web. Then decide: how many partial waves are important?

If $a = .117$, $b = 0.0681$, $c = 0.011$, calculate all the scattering phaseshifts, δ_l , that you can.