

- 2      **B)**      What is meant in particle physics by a *virtual process*? Explain why such a process is important in describing the elastic scattering of two particles by means of the exchange of a third particle. In the case of weak and electromagnetic forces, show that the range of the force present in the interaction depends on the mass of the exchanged particle. In each of these cases, identify the exchanged particle, give an approximate mass of the particle involved and hence estimate the typical range over which each force acts. {12}

Define *helicity* and show that it is a pseudoscalar quantity.

Describe the experiment of Goldhaber *et al* (1958) which measured the *handed-ness* of the electron neutrino. Indicate how the experimenters concluded from their observations that the electron neutrino is left handed. Given this result, and that the anti electron neutrino is right handed, comment on:

- a)      the expected mass of the neutrino,
- b)      the application of the charge conjugation and parity operators (separately and together) to the neutrino state. {12}