CHAPTER 6

Many-Body Perturbation Theory

6.1 Rayleigh-Schrödinger (RS) Perturbation Theory

6.2 Diagrammatic Representation of RS Perturbation Theory

6.2.1 Diagrammatic Perturbation Theory for Two States

Exercise 6.1

Write down and evaluate all fifth-order diagrams that have the property that an imaginary horizontal line crosses only one hole and one particle line. Show that the sum of such diagrams is

$$\frac{V_{12}V_{21}(V_{22}-V_{11})^3}{(E_1^{(0)}-E_2^{(0)})^4}$$

Hint: There are eight such diagrams, and they can be generated by adding three dots to the second-order diagram in all positive ways.

Solution 6.1

6-1 so

6.2.2 Diagrammatic Perturbation Theory for N States