

Solutions

2.1 D The same-orbital spatial product is symmetric; the spin factor must be antisymmetric.

Compare the rejected options: $\uparrow\uparrow$; $\downarrow\downarrow$; Symmetric $\uparrow\downarrow+\downarrow\uparrow$ triplet; Any spin state. Use the stated model and conditions.

2.2 C Allowed patterns are (2,0), (1,1) and (0,2); particle labels do not create separate versions of (1,1).

Compare the rejected options: 1; 2; 4; 6. Use the stated model and conditions.

2.3 15. Six complete states give $\text{choose}(6,2)=15$.

2.4 True. At $x_1=x_2$ the two products are equal and their difference vanishes.

3.1 Symmetric spatial states: three double occupations plus three different-orbital symmetric pairs, giving six singlets. Antisymmetric space has three orbital pairs; each permits three triplet spin projections, giving nine triplet states. Total is 15, equal to $\binom{6}{2}$. Award double occupations, singlet total, antisymmetric pairs, triplet total and reconciliation. Counting only the three triplet multiplets would omit their spin projections.