The figure below shows the lowest energy levels of He with possible occupations.

- 0 - 1s^2
- 1 - 1s^2
- 0 - 1s^2
- 0 - 1s^2
- 1 - 1s^2
- 1 - 1s^2

- 0 - 1s^2
- 1 - 1s^2
- 1 - 1s^2
- 1 - 1s^2

0 and 1 indicate spins:
0 = \uparrow
1 = \downarrow

The 0 levels have the upper e^- antiparallel to the 1s.
The 1 levels have the upper e^- parallel to 1s.

(a) Explain why 1s^2 has only a 0 level config.

(b) Indicate allowed transitions

(c) Which levels are metastable?

(a) The Pauli exclusion principle requires the two e^- in 1s^2 to have opposite spins; thus there can't be a "1" state with the e^- parallel (well, there can be, as the 21 cm line shows, but it's not very probable).

(b) Allowed transitions have \( \Delta L = \pm 1 \) and \( \Delta S = 0 \) -> a "0" level (e^- antiparallel) can only transition to a "0" level. Same for "1" levels.

(c) The metastable states are 1s2s 0 and 1 since there is no allowed downward transition.