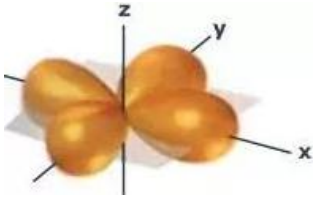
1. a) Use the aufbau principle to explain why electrons fill the 4s orbital before the 3d orbital.
b) Use the orbital box notation of helium to explain the Pauli exclusion principle.
c) Use the orbital box notation of carbon to explain Hund's rule.
(d) (i) In which subshell is this orbital found (s, p, d or f)?
(ii) What is meant by degenerate orbitals?
(iii) Using axes, show the shape of the degenerate p orbitals.



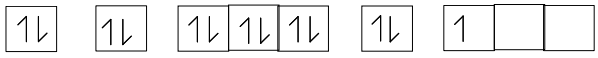
2. The electronic configuration of sodium can be written as:

Sodium: 2,8,1 → $1s^2\ 2s^2\ 2p^6\ 3s^1$

In a similar way, give the electronic configuration for the following particles.

(a) Be (b) F (c) Mg^{2+} (d) Ti (e) S^{2-} (f) Ni (g) Zn (h) O (i) P

3. The electronic configuration of aluminium can be expressed as:

Aluminium atomic no. 13 

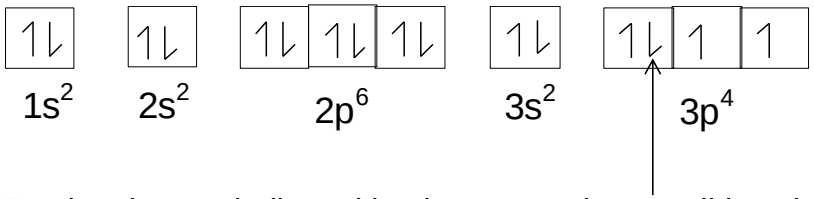
Express the following particles in a similar way to the example shown above.

(a) Cl (b) B (c) Na (d) Fe (e) Co (f) Ne (g) C (h) Sc

4. Give the names of the following elements that have been represented by their electronic configuration in shorthand form.

a) [Ar] $4s^2\,3d^5$ b) [Ne] $3s^2\,3p^4$ c) [Ar] $4s^2\,3d^8$

5. The orbital box notation of the electronic configuration of sulfur is given as:



For the electron indicated by the arrow, give possible values for the four quantum numbers, n, ℓ, m_ℓ and m_s.

6. Copy the table below and complete it to show a possible set of quantum numbers for the outer 3d electron in titanium.

Quantum number	n	ℓ	m_ℓ	m_s
Value				

7. Beryllium and boron do not fit the general trend for the first ionisation energy of period 2 elements. Explain why an anomaly occurs with the first ionisation energy of beryllium and boron.