1 Which one of the following elements requires the least energy to remove one electron from one gaseous atom?

A Aluminium
B Chlorine
C Magnesium
D Sodium

2 The symbol for the nitride ion is $\text{N}^{3-}$. Which one of the following statements about the outermost electron sub-shell of this ion is correct?

A The sub-shell has three p-type electrons
B The sub-shell has six p-type electrons
C The sub-shell has five p-type electrons
D The sub-shell has three s-type electrons
3 The following graphs represent the values of successive ionisation energies \( \log_{10} \Delta H_i \) plotted against the number of electrons removed. Which graph represents the successive ionisation energies for carbon (atomic number = 6).

4 A Cr atom has the electronic configuration \( 1s^2 2s^2 2p^6 3s^2 3p^6 3d^5 \) 4s\(^1\). Which one of the following electronic structures represents the electronic configuration of a Cr\(^{3+}\) ion?

A \( 1s^2 2s^2 2p^6 3s^2 3p^6 3d^2 4s^1 \)

B \( 1s^2 2s^2 2p^6 3s^2 3p^4 3d^5 \)

C \( 1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 \)

D \( 1s^2 2s^2 2p^6 3s^2 3p^3 3d^6 \)
5 To which group of the Periodic Table does the element with the electronic configuration $1s^2 2s^2 2p^3$ belong?

A Group 2  
B Group 3  
C Group 5  
D Group 7

6 Which one of the following phrases best describes the term 2nd ionisation energy?

A The energy needed to remove one electron from each atom in 1 mole of gaseous atoms  
B The energy needed to remove one electron from each ion in 1 mole of gaseous $1^+$ ions  
C The energy needed to remove one electron from each ion in 1 mole of gaseous $2^+$ ions  
D The energy needed to add one electron to each ion in 1 mole of gaseous $1^+$ ions

7 Which one of the following diagrams represents the shape of a single $p$ orbital?
8 Which one of the following equations represents the 3rd ionisation energy of calcium?

A \( \text{Ca}(g) \rightarrow \text{Ca}^{3+}(g) + 3e^- \)

B \( 3\text{Ca}^{2+}(g) \rightarrow 3\text{Ca}^{3+}(g) + 3e^- \)

C \( \text{Ca}^{3+}(g) \rightarrow \text{Ca}^{4+}(g) + e^- \)

D \( \text{Ca}^{2+}(g) \rightarrow \text{Ca}^{3+}(g) + e^- \)

9 Which one of the following statements about 1st ionisation energy is correct?

A Across a period in the Periodic Table, the 1st ionisation energy increases as the proton number decreases

B Down a group in the Periodic Table, the 1st ionisation energy increases as the total number of electrons increases

C Down a group in the Periodic Table, the 1st ionisation energy decreases as the number of full electron shells between the outer electrons and the nucleus increases

D The 1st ionisation energy increases the further the outer electron shell is from the nucleus
10 Which one of the following diagrams shows how \( \log_{10} \) 1st ionisation energy varies with increasing atomic number in Period 3 of the Periodic Table?