1. Complete the diagram showing the general trends in Group 2 by choosing properties from the grey boxes to annotate the arrows. (7 marks)

2. The trend in solubility of the sulfates is useful as it provides a test for the sulfate anion. Describe how this test is carried out, what is observed when the test is positive for sulfate ions and write an equation including state symbols for this test. (3 marks)
2. The enthalpy change when one mole of **electrons is removed** (1) from **one mole of gaseous atoms** (1) to give one mole of gaseous unipositive ions. Eg, \( M (g) \rightarrow M^+ (g) + e^- \) (1)

### 4.1.3

1. Atomic radius decreases across the Period (1 mark)  
   More protons in the nucleus (1 mark)  
   Negligible increase in shielding as electrons are in the same main energy level (1 mark)  
   Greater attraction between the outer electrons and the nucleus/greater effective nuclear charge therefore electrons ‘pulled’ in. (1 mark)

2.  
   ![Diagram of atomic radius](image)
   1 mark for 2 atoms with nucleus and no overlap  
   1 mark for showing internuclear distance  
   1 mark for showing relationship between internuclear distance and atomic radius

   Atomic radius = \( d/2 \)

3. Argon is not bonded (1 mark) therefore it is not ‘squashed’ and has a true atomic radius (1 mark)

4. As atomic radius decreases the 1st ionisation energy increases (or converse) (1 mark)

### 4.2

1. (1 mark for each correct)

   ![Diagram of properties](image)

2. Barium chloride solution (\( \text{BaCl}_2 \)) is added to the test solution (1 mark for identification of chemical). Dilute hydrochloric acid is added. If sulfate ions are present a white precipitate is formed (1 mark for observation).  
   \[
   \text{Ba}^{2+} (aq) + \text{SO}_4^{2-} (aq) \rightarrow \text{BaSO}_4 (s) \ (1 \text{ mark})
   \]