Structure and Bonding [D]

1. Ionic compounds are formed between metals and non-metals.

    a. Draw a diagram to show the formation of a magnesium ion from an atom: **[3]**

    b. Explain, using abbreviated electronic configurations (e.g. 2:8:1), why the formula of aluminium chlorine is $AlCl_3$: **[3]**

    c. Define the term *ionic bond*: **[2]**

    d. Potassium fluoride is a typical ionic substance. State and explain whether it has a high or low melting point: **[3]**

2. Covalent substances form when non-metal atoms share electrons.

    a. Hydrogen sulphide (H_2S) is a typical simple molecular substance.

        i. Define the term *molecular*: **[2]**

        ii. Explain why hydrogen sulphide is a gas at room temperature and pressure: **[3]**

        iii. Draw a dot-and-cross diagram to show the structure of a hydrogen sulphide molecule: **[2]**

    b. Giant covalent structures, such as diamond, are enormous lattices of atoms interconnected by covalent bonds.

        i. Define the term *covalent bond*: **[2]**

ii. Diamonds sublime at an extremely high temperature. Explain why in terms of their structure and bonding: **[3]**

3. A definitive property of metals is that their atoms readily lose electrons.

    a. State the term used to describe loss of electrons: **[1]**

    b. Draw a diagram to show the structure of lithium: **[3]**

    c. Define the term *metallic bonding*: **[2]**

    d. Explain why the metal calcium is malleable: **[2]**

Structure and Bonding [D]

1. Ionic compounds are formed between metals and non-metals.

    a. Draw a diagram to show the formation of a magnesium ion from an atom: **[3]**

    atom drawn with EC of 2:8:2 [1]

    ion drawn with EC of 2:8 [1]

    square brackets and 2+ charge on ion [1]

    b. Explain, using abbreviated electronic configurations (e.g. 2:8:1), why the formula of aluminium chloride is $AlCl_3$: **[3]**

    aluminium (2:8:3) needs to lose 3 electrons [1]

    chlorine (2:8:7) can only take 1 electron [1]

    so you need three chlorines for every aluminium [1]

    c. Define the term *ionic bond*: **[2]**

    the electrostatic attraction [1]

    between oppositely charged ions [1]

    d. Potassium fluoride is a typical ionic substance. State and explain whether it has a high or low melting point: **[3]**

    It has a high melting point [1]

    The forces (ionic bonds) between the ions are very strong [1]

    Lots of energy is required to break them [1]

2. Covalent substances form when non-metal atoms share electrons.

    a. Hydrogen sulphide (H_2S) is a typical simple molecular substance.

        i. Define the term *molecular*: **[2]**

        composed of a group of atoms [1]

        held together by covalent bonds [1]

        ii. Explain why hydrogen sulphide is a gas at room temperature and pressure: **[3]**

        the forces between hydrogen sulphide molecules are weak [1]

        they require little energy to overcome [1]

        even room temperature provides enough energy to completely separate the molecules [1]

        iii. Draw a dot-and-cross diagram to show the structure of a hydrogen sulphide molecule: **[2]**

        One shared pair of electrons between the S and each of the two Hs [1]

        Four other electrons around the S [1]

    b. Giant covalent structures are enormous lattices of atoms interconnected by covalent bonds.

        i. Define the term *covalent bond*: **[2]**

        the electrostatic attraction [1]

        between two nuclei and a shared pair of electrons between them [1]

ii. Diamonds sublime at an extremely high temperature. Explain why in terms of their structure and bonding: **[3]**

diamond consists of C atoms held together by lots of covalent bonds [1]

these bonds are very strong [1]

huge amounts of energy are required to break them [1]

3. A definitive property of metals is that their atoms readily lose electrons.

   a. State the term used to describe loss of electrons: **[1]**

   oxidation [1]

   b. Draw a diagram to show the structure of lithium: **[3]**

   regular arrangement of Li^+ ions (at least 2x3 rectangle) [1]

   some delocalised electrons [1]

   the same number of delocalised electrons as Li^+ ions [1]

   c. Define the term *metallic bonding*: **[2]**

   the electrostatic attraction [1]

   between positive metal ions and the sea of delocalised electrons [1]

   d. Explain why the metal calcium is malleable: **[2]**

   layers of metal ions can slide over each other [1]

   without breaking the metallic bonding [1]