Bonding and Compound Properties Review

1. Some trends in properties have already been demonstrated with elements in the Periodic Table. However, trends are also evident within compounds.
   a. Identify the most reactive halogen and the least reactive alkali metal. Draw Lewis symbols of each and show the formation of a compound between these elements.
   b. Name this compound. What type of bond is formed when these elements react?
   c. Explain how the type of bonding causes **one** physical property of this type of compound.
   d. Complete **Table 1**.

Table 1. Compounds formed between lithium and the halogens

Compound	Melting point (^{o}C)	Difference in electronegativity
LiF		
LiCl		
LiBr		
LiI		

   e. Explain the trend in melting point for these compounds. What does this indicate about the strength of the ionic bond?
   f. How does the strength of the ionic bond relate to the difference in electronegativity between the elements forming the bond?

2. The halogens are very reactive elements and will easily form compounds with the alkali metals. However, their reactivity also facilitates bonding with any element – such as carbon.
   a. Draw the Lewis diagram of the compound formed by carbon and fluorine.
   b. Name this compound. What type of compound do the halogens form with carbon? Be specific.
   c. Give two physical properties of this type of compound.
   d. Complete **Table 2**.

Table 2. Compounds formed by carbon and the halogens

Compound	State of matter at SATP	Melting point (^{o}C)	Total number of electrons
CF_4			
CCl_4			
CBr_4			
CI_4			

   e. Considering the physical properties of these compounds, what does this information indicate about the forces between molecules for these compounds?
   f. How does the strength of the intermolecular forces relate to the total number of electrons within the molecules?

3. Nitrogen and phosphorus are in the same group in the Periodic Table and both elements form gaseous compounds with hydrogen – ammonia, $NH_{3(g)}$, and phosphine, $PH_{3(g)}$.
   a. Draw the Lewis structure of each compound.
   b. What are the similarities and the differences between the N-H bond and the P-H bond?
   c. Ammonia boils at -33°C while phosphine boils at -88°C. Which compound has the stronger intermolecular forces? Considering periodic trends, explain the difference in strength of these forces.

4. Mr. Inman discovers a blue solid under an old cupboard in the chemistry lab. As a responsible chemist, he simply cannot throw it out. The identity of the substance needs to be known before it can be disposed – correctly, so he decides to do some tests on it.

Test	Observations
(a) hits substance with hammer	• breaks into smaller crystals; hard little pieces
(b) places solid into H_2O	• dissolves into the solution; able to conduct electricity (solution turns light bulb on)
(c) heats solid in test tube with flame	• changes colour (blackens) and releases a gas; gas makes limewater turn milky • has a very high melting point, >500°C

a. From the observations Mr. Inman made, indicate one chemical and one physical property that were discovered about the solid.
b. From the observations, what type of substance was the blue solid? Defend your choice. Be as specific as possible.
c. Based on intramolecular forces, explain the high melting point of the substance.
d. Explain what allows this compound to act as an electrolyte when dissolved in solution.