# Answers to Periodic Table Lesson Questions : U2Ch5L1

## Essential Question

1. How has the periodic table evolved into a powerful tool for understanding elements and their properties?  
 - The periodic table has evolved from early arrangements based on atomic mass to the modern organization by atomic number, thanks to contributions from scientists like Mendeleev and Moseley. This arrangement allows scientists to predict the properties and behaviors of elements based on their positions, enabling insights into chemical reactivity, trends, and relationships between elements.

## Curiosity Corner

2. Why do we use different salts, like sodium chloride, magnesium chloride, or calcium chloride, instead of just one for deicing roads?  
 - Different salts have varying effectiveness depending on the environmental temperature and their chemical properties. Sodium chloride is commonly used, but magnesium chloride and calcium chloride are more effective at lower temperatures due to their higher exothermic heat of dissolution.

3. How are elements like sodium, magnesium, and calcium different based on their positions in the periodic table?  
 - These elements are all metals but belong to different groups. Sodium is in Group 1 (alkali metals) and has one valence electron, making it highly reactive. Magnesium and calcium are in Group 2 (alkaline earth metals) and have two valence electrons, making them less reactive than sodium but similar in their chemical behavior.

4. What makes these elements behave similarly or differently?  
 - Elements behave similarly when they belong to the same group due to their similar valence electron configurations. Differences arise from their positions in the periodic table, which affect their atomic size, ionization energy, and electronegativity.

## Progress Check 1

5. How did the shift of elemental parameters from atomic mass to atomic number improve the accuracy of the periodic table?  
 - Arranging elements by atomic number resolved inconsistencies found in earlier tables organized by atomic mass. For example, iodine and tellurium were misplaced based on mass but correctly positioned when ordered by atomic number. This shift aligned the table with the periodic law and improved predictions of chemical properties.

## Pathfinder

6. Given the following atoms, propose a way to organize them in a chart to predict their properties: Al, Ar, B, Be, Br, C, Ca, Cl, F, H, He, Li, K, Mg, N, Na, Ne, O, P, S, Si.  
 - The elements can be organized by increasing atomic number. Group them vertically based on similar valence electron configurations to reflect similar properties, and arrange them horizontally in periods to show a progression in properties as atomic number increases.

## Progress Check 2

7. Given the following elements arranged by atomic mass: lithium (Li), potassium (K), and rubidium (Rb), predict which element might come next.  
 - Based on atomic mass and group trends in the periodic table, cesium (Cs) would come next in the sequence.

## Progress Check 3

8. Given the atomic numbers of sulfur (16) and chlorine (17), predict which element comes next in the periodic table when arranged by atomic number.  
 - The next element is argon (Ar), with an atomic number of 18, completing the third period in the periodic table.

## Lesson Check

9. How does the arrangement of elements by atomic number resolve the inconsistencies found in earlier tables organized by atomic mass?  
 - The atomic number reflects the number of protons in an element, which defines its identity. This arrangement corrected placements like iodine and tellurium, which appeared out of order based on atomic mass but aligned correctly by atomic number. This improved the periodic table's predictive power for element properties.

10. Explain how the organization of the periodic table according to atomic number improved the accuracy and predictability of element properties compared to earlier versions arranged by atomic mass. Include examples of elements that were reordered correctly.  
 - Organizing elements by atomic number fixed inconsistencies like iodine and tellurium. By aligning elements based on proton count, their properties (e.g., valency and reactivity) matched group trends, making the table a reliable tool for predicting chemical behavior.

11. Discuss the significance of electron configuration in the periodic table. How does the arrangement of electrons determine the reactivity and chemical properties of elements in the same group?  
 - Electron configuration determines an element's chemical behavior. Elements in the same group have similar valence electron configurations, leading to comparable reactivity. For instance, alkali metals (Group 1) all have one valence electron, making them highly reactive.

12. Explain the concept of periodic trends and how they vary across periods and groups. Provide examples of how these trends can be used to predict the behavior of elements.  
 - Periodic trends include electronegativity, ionization energy, and atomic radius. For example, electronegativity increases across a period and decreases down a group. This explains why fluorine (Group 17) is highly reactive, while cesium (Group 1) is less reactive.

## Beyond the Lesson

13. How have scientists used the periodic table in the development of new materials, such as lightweight alloys for airplanes or superconductors for advanced electronics?  
 - Scientists use the periodic table to identify elements with specific properties, like lightweight yet strong metals (e.g., titanium alloys for aviation) or elements with unique electronic properties for superconductors (e.g., niobium and yttrium-based compounds).

14. What role do elements play in emerging technologies like renewable energy sources?  
 - Elements like silicon are essential in solar panels, while lithium powers batteries for electric vehicles. Rare earth elements improve the efficiency of wind turbines and other renewable technologies.

15. How do the properties of elements influence their applications in technologies like solar panels or batteries?  
 - High conductivity and durability make silicon ideal for solar cells, while lithium’s low weight and high electrochemical potential make it ideal for rechargeable batteries.

16. Why are certain materials better suited for specific purposes, such as corrosion resistance or conductivity?  
 - Materials like stainless steel resist corrosion due to chromium content, while copper is preferred for electrical wiring because of its excellent conductivity and ductility.