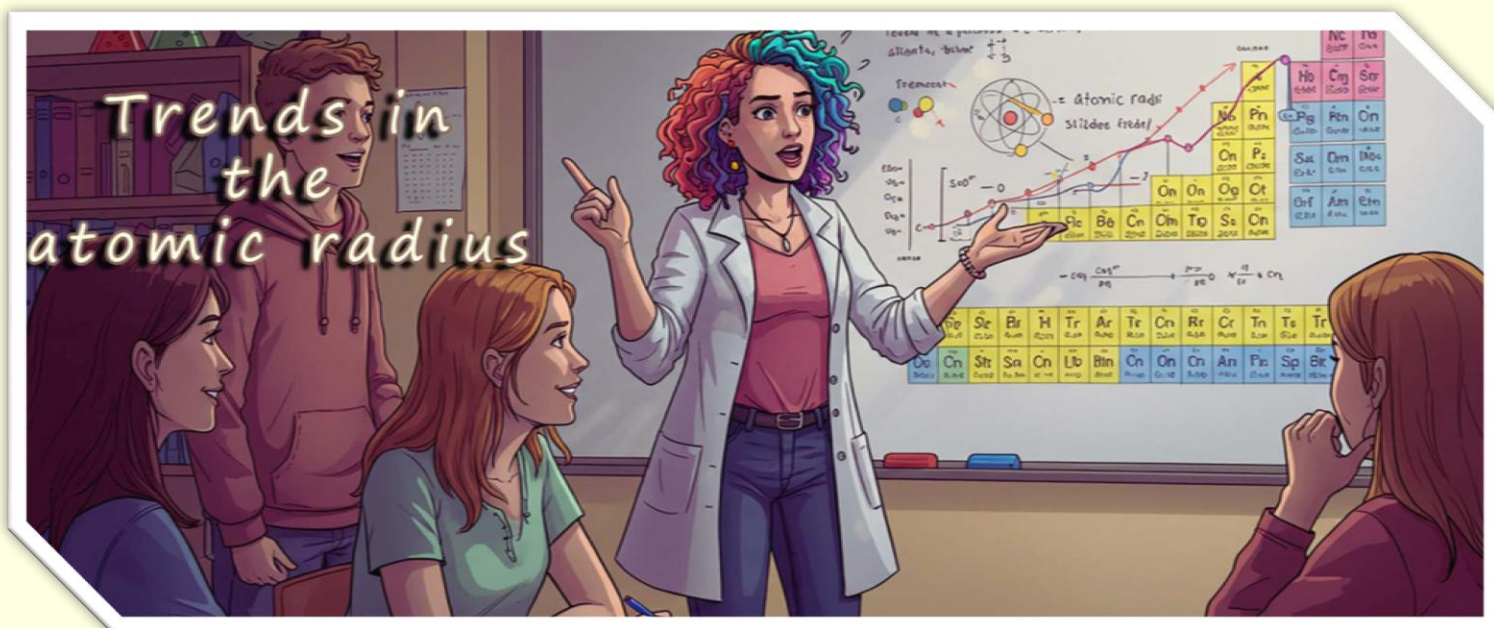
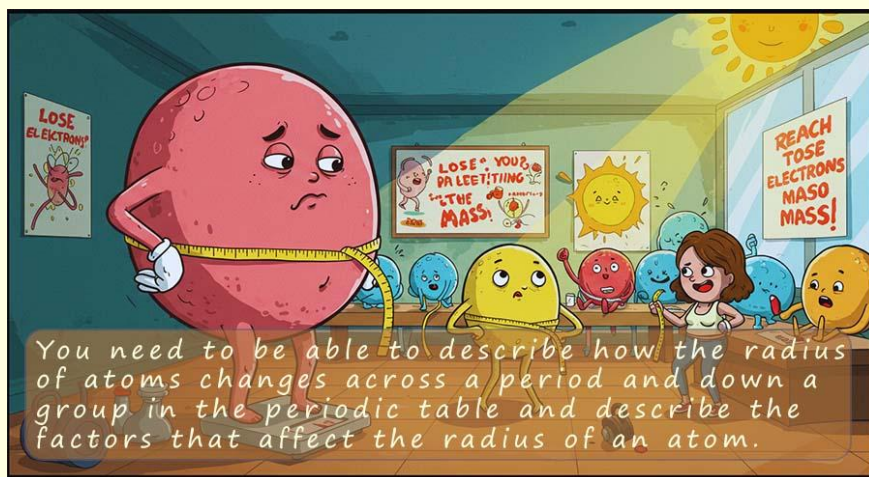


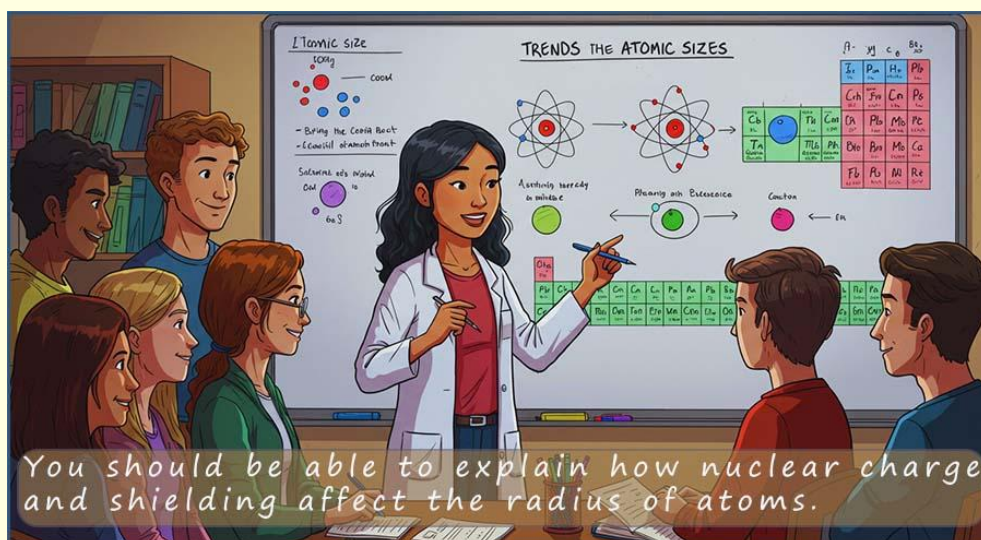


Answer the questions below then check your answers.

1. Define the term 'atomic radius'.
2. Explain how the atomic radius changes across a period in the periodic table.
3. Explain why atomic radius decreases across a period, even though the number of electrons increases.
4. Explain how the atomic radius changes down a group in the periodic table.
5. Explain why atomic radius increases down a group, despite the increase in nuclear charge.
6. Describe the difference between a covalent radius and a metallic radius.
7. Why do atoms have no sharp outer boundary, and how does this affect how we define atomic radius?
8. What is meant by the term 'shielding' and how does it affect the atomic radius?



9. What is meant by the term 'effective nuclear charge (Z_{eff})' and how does it change across a period?
10. Compare the atomic radii of sodium and chlorine. Explain your reasoning.
11. Compare the atomic radii of lithium and sodium. Explain your reasoning.
12. Why do exam boards prefer to use the term 'atomic radius' rather than 'covalent radius' or 'metallic radius'?



Answers

1. The atomic radius is defined as half the distance between the nuclei of two bonded atoms.
2. Across a period, the atomic radius decreases.
3. Across a period, electrons are added to the same principal energy level while the number of protons (nuclear charge) increases. Shielding remains approximately constant, so the increased attraction between the nucleus and electrons pulls the electrons closer.
4. Down a group, the atomic radius increases.
5. Down a group, each element has an extra electron shell, increasing the distance between the outer electrons and the nucleus. Increased shielding reduces the effect of the greater nuclear charge, leading to a larger atomic radius.
6. The covalent radius is half the distance between the nuclei of two atoms joined by a covalent bond. The metallic radius is half the distance between the nuclei of two neighbouring atoms in a metallic lattice.
7. Atoms do not have a sharp outer edge because orbitals fade gradually. This means atomic size cannot be measured directly; instead, it is defined using distances between bonded atoms.
8. Shielding is the reduction in the attraction between the nucleus and outer electrons caused by repulsion from inner shell electrons. Greater shielding increases atomic radius.

9. Effective nuclear charge (Z_{eff}) is the net positive charge experienced by valence electrons after accounting for shielding. Across a period, Z_{eff} increases as nuclear charge increases but shielding stays constant.
10. Chlorine has a smaller atomic radius than sodium because both are in the same period, but chlorine has a higher nuclear charge and similar shielding, pulling electrons closer.
11. Sodium has a larger atomic radius than lithium because it has an extra electron shell and more shielding, increasing the distance of the outer electron from the nucleus.
12. Because 'atomic radius' is a general term that applies to different bonding situations, while 'covalent radius' and 'metallic radius' are specific to particular types of bonding.