Class 9 Science Practice Worksheet

New NCERT Syllabus (2026-27) - Exploration Science

Chapter 6: Structure of an Atom

Section A: Conceptual Section (5 Questions)

Q1. Identify the fundamental properties of atomic structures:
(a) The maximum number of electrons that can be accommodated in the outermost shell of an atom is _____.
(b) The subatomic particle discovered by James Chadwick that carries no electrical charge is the _____.
(c) Elements containing the exact same atomic number but different mass numbers are classified as _____.

Q2. Match the specific atomic models with their correct descriptive definitions or creators:
(a) Plum Pudding / Watermelon Model: _____
(b) Alpha-particle Scattering Experiment: _____
(c) Discrete orbits called stationary shells: _____

Q3. State whether the following statements are True or False:
(a) The mass of an electron is considered to be nearly equal to the mass of a proton. (***)***
***(b) Valency is determined by the total number of electrons present in the innermost K shell of an atom. (***)
(c) Isobars are atoms of different elements that share the exact same mass number. (_____)

Q4. Write down the chemical symbol and the complete electronic configuration (K, L, M, N distribution) for the following elements:
(a) Carbon (Atomic Number = 6): Symbol = _____, Configuration = _____
(b) Sodium (Atomic Number = 11): Symbol = _____, Configuration = _____
(c) Argon (Atomic Number = 18): Symbol = _____, Configuration = _____

Q5. An unknown neutral atom has 13 protons and 14 neutrons sitting inside its nucleus. Calculate its total mass number, identify the element, and determine its valency. Show your step-by-step concepts.

Section B: Logical Section (5 Questions)

Q6. Look carefully at two elements: Element A has an atomic number of 8 and a mass number of 16. Element B has an atomic number of 8 and a mass number of 18.
(a) Logically deduce the relationship between Element A and Element B: _____

(b) Do these two elements share the same chemical properties? Why or why not?

_____

(c) Calculate the exact number of neutrons inside the nucleus of Element B: _____.

Q7. Thomson proposed that an atom consists of a positively charged sphere with electrons embedded in it. Explain logically how Rutherford's alpha-particle scattering experiment proved this specific model to be incorrect.

Q8. You are analyzing an ion represented as Mg^{2+} (Magnesium ion). The atomic number of Magnesium is 12, and its mass number is 24. Logically deduce the following quantities for this specific ion:

(a) Total number of protons: _____

(b) Total number of electrons: _____

(c) Total number of neutrons: _____

Q9. The electronic configuration of an element Z is written as 2, 8, 7.

(a) Logically calculate the combining capacity (valency) of this element: _____

(b) Is Z classified as a metal or a non-metal? Explain your logical deduction based on its valence shell.

Q10. Predict structural limits logically: According to Bohr-Bury rules, the maximum number of electrons in any shell is given by the formula $2n^2$, where n is the shell number. Logically explain why the M shell (n=3) in Potassium (Atomic Number = 19) holds only 8 electrons instead of filling up to its maximum capacity of 18 before the N shell begins.

Section C: High Thinking Section / HOTS (5 Questions)

Q11. Helium has 2 electrons in its valence shell, and its valency is 0. Magnesium also has 2 electrons in its valence shell, but its valency is 2. Explain the high-level chemical logic behind this difference by analyzing their respective shell capacities.

Q12. Analyze an atomic mass scenario: A natural sample of an unknown element X consists of two distinct isotopic forms. 75% of the sample exists as X-35 (mass number 35), and 25% of the sample exists as X-37 (mass number 37). Calculate the precise average atomic mass of element X. Show your complete mathematical work.

Q13. Compare and contrast the structural logic of atomic distributions: If an atom has its K and L shells completely full, and no other shells contain any electrons:
(a) What is the total number of electrons in the atom? _____
(b) Name the specific noble gas element this configuration represents: _____
(c) Explain why this element is chemically inert.

Q14. An atom has an atomic mass number equal to 40, and it contains 22 neutrons in its nucleus.
(a) Calculate its atomic number and write its electronic configuration.
(b) If another atom has an atomic number of 18 and a mass number of 40, explain why these two atoms are categorized as isobars despite having entirely different structures.

Q15. Think deeply about nuclear models: Rutherford's nuclear model of the atom was highly revolutionary, yet it suffered from a major theoretical instability flaw regarding revolving electrons. Explain why Maxwell's electromagnetic theory predicted that Rutherford's atom should collapse, and how Niels Bohr solved this problem.

Answer Key (For Teachers and Parents)

Section A:
Q1: (a) 8 (Octet rule), (b) neutron, (c) isotopes.
Q2: (a) J.J. Thomson, (b) E. Rutherford, (c) Niels Bohr.
Q3: (a) False (electron mass is negligible, about 1/2000th of a proton), (b) False (valency depends on the outermost valence shell), (c) True.
Q4: (a) C, (2, 4); (b) Na, (2, 8, 1); (c) Ar, (2, 8, 8).
Q5: Mass Number = Protons + Neutrons = 13 + 14 = 27. The element with atomic number 13 is Aluminium (Al). Electronic configuration is 2, 8, 3. Since it has 3 valence electrons, it loses them to achieve an octet, so its valency is 3.

Section B:
Q6: (a) They are isotopes. (b) Yes, because they have the same atomic number and electronic configuration, which dictates chemical behavior. (c) Neutrons in B = Mass number - Atomic number = 18 - 8 = 10.
Q7: Thomson's model predicted that positive charge was spread uniformly, so alpha particles should pass through with minor deflections. Rutherford observed that most particles passed straight, but a tiny fraction (1 in 12,000) bounced back completely. This

logically proved that the positive charge is concentrated in a tiny, dense center (the nucleus).

Q8: (a) Protons = 12 (remains unchanged), (b) Electrons = 12 - 2 = 10 (the 2+ charge indicates it lost 2 electrons), (c) Neutrons = 24 - 12 = 12.

Q9: (a) Valency = 8 - 7 = 1. (b) Non-metal, because elements with 5, 6, or 7 valence electrons tend to gain electrons to complete their octet rather than losing them.

Q10: The Bohr-Bury rules state that the outermost shell of an atom cannot accommodate more than 8 electrons, even if it has the capacity for more. Once the M shell reaches 8 electrons, it becomes temporarily stable, and the next electrons begin filling the N shell.

Section C:

Q11: Helium has only one shell (the K shell), whose maximum capacity is exactly 2 electrons (duplet rule). Since its only shell is completely full, it is highly stable and has a valency of 0. Magnesium has three shells (2, 8, 2). Its outermost M shell needs 8 electrons for stability, so it readily loses its 2 valence electrons, giving it a valency of 2.

Q12: Average Atomic Mass = (35 × 75/100) + (37 × 25/100) = (35 × 3/4) + (37 × 1/4) = 105/4 + 37/4 = 142/4 = 35.5 u.

Q13: (a) K shell holds 2, L shell holds 8. Total = 2 + 8 = 10 electrons. (b) Neon (Ne). (c) It is inert because its outermost valence shell (L) is completely satisfied with an octet (8 electrons), leaving no tendency to gain, lose, or share electrons.

Q14: (a) Atomic Number = Mass Number - Neutrons = 40 - 22 = 18. Electronic configuration is 2, 8, 8. (b) They are isobars because they have the exact same total mass number (40), even though their atomic numbers (and chemical identities) are completely different (Argon and Calcium-40).

Q15: According to electromagnetic theory, any charged particle moving in a circular path must accelerate and radiate energy continuously. Rutherford's revolving electrons should lose energy, slow down, and spiral inward, eventually crashing into the nucleus, making the atom unstable. Bohr resolved this by postulating that electrons revolve only in specific "discrete orbits" where they do not radiate energy.