

CLASS IX SCIENCE (CHEMISTRY) — PRACTICE WORKSHEET

Chapter 8: **Journey Inside the Atom** (NCERT Exploration, Grade 9)

Time: 2 Hours 30 Minutes	Maximum Marks: 80
Name: _____	Roll No. / Date: _____

General Instructions: (1) All questions are compulsory; internal choice is given in one 5-mark question. (2) Marks are shown in square brackets. (3) Section A: 16 MCQs (1 mark each); B: 4 Assertion-Reason (1); C: 5 Fill-in/True-False (1); D: 7 Very Short Answer (2); E: 6 Short Answer (3); F: 3 Long Answer (5); G: 2 Case-Based (4 each). (4) Draw neat, labelled diagrams wherever required. (5) Show all steps in numerical problems.

SECTION A — Multiple Choice Questions

16 questions × 1 mark = 16 marks. Choose the most appropriate option.

Q1. Which of the following statements about the early ideas of atom proposed by Acharya Kanada and Democritus is correct? [1]

- | | |
|--|---|
| (a) They were based on cathode-ray experiments. | (b) They specified the proportions in which atoms combine. |
| (c) They were philosophical ideas that did not arise from experimental observations. | (d) They proved that atoms can be divided into smaller particles. |

Q2. Thomson concluded that electrons are a fundamental part of every atom mainly because the cathode rays: [1]

- | | |
|---|--|
| (a) behaved the same irrespective of the material of the cathode and the gas in the tube. | (b) moved from the anode to the cathode. |
| (c) were not affected by electric and magnetic fields. | (d) carried a positive charge. |

Q3. Which observation-conclusion pair from the gold foil experiment is **INCORRECT**? [1]

- | | |
|---|--|
| (a) Most α -particles passed undeflected – most of the atom is empty space. | (b) A few α -particles bounced back – the positive charge and most of the mass lie in a dense centre. |
| (c) Some α -particles deflected at large angles – the positive charge is concentrated in a small region. | (d) α -particles passed through the foil – the nucleus contains neutral particles called neutrons. |

Q4. The diameter of an atom is about 10^{-10} m and that of its nucleus about 10^{-15} m. Treating both as spheres, the approximate ratio of the **volume** of the atom to the volume of its nucleus is: [1]

- | | |
|---------------|---------------|
| (a) 10^5 | (b) 10^{15} |
| (c) 10^{10} | (d) 10^{25} |

Q5. Which of the following is correct according to Bohr's model? [1]

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|---|---|
| (a) An electron in the L-shell continuously loses energy and spirals inward. | (b) An electron can jump from the K-shell to the L-shell by absorbing energy equal to $E_L - E_K$. |
| (c) An electron in the K-shell has more energy than an electron in the M-shell. | (d) Electrons can revolve in the space between two allowed shells. |

Q6. An element has the electronic configuration 2, 8, 8, 2. Its number of protons and valency respectively are: [1]

- | | |
|--------------|--------------|
| (a) 20 and 2 | (b) 18 and 2 |
| (c) 20 and 8 | (d) 12 and 2 |

- Q7.** Which of the following pairs are **isobars**? [1]
(a) hydrogen-1 and hydrogen-2 (b) chlorine-35 and chlorine-37
(c) carbon-12 and carbon-13 (d) argon-40 ($Z = 18$) and calcium-40 ($Z = 20$)
- Q8.** An element Y occurs as two isotopes of mass 10 u and 11 u. If its average atomic mass is 10.8 u, the percentage abundance of the heavier isotope is: [1]
(a) 20% (b) 50%
(c) 80% (d) 90%
- Q9.** An ion X^{2-} has 18 electrons and 18 neutrons. The mass number of the neutral atom X is: [1]
(a) 32 (b) 36
(c) 34 (d) 38
- Q10.** Read the statements: [1]
(i) Neutrons reduce the repulsion between protons in a nucleus.
(ii) Isotopes of an element have identical physical properties.
(iii) Isotopes have similar chemical properties as they have the same electronic configuration.
(iv) Mass number of an atom is always greater than or equal to its atomic number.
Which are correct?
(a) (i), (ii) and (iii) (b) (i), (ii) and (iv)
(c) (ii), (iii) and (iv) (d) (i), (iii) and (iv)
- Q11.** Carbon (2, 4) and silicon (2, 8, 4) show the same valency because they have the same: [1]
(a) number of valence electrons (b) number of shells
(c) atomic number (d) mass number
- Q12.** By the $2n^2$ rule the N-shell can hold 32 electrons. In the atoms of the **first twenty elements**, the maximum number of electrons actually present in the N-shell is: [1]
(a) 32 (b) 2
(c) 8 (d) 18
- Q13.** Arrange these events in correct chronological order: [1]
P - discovery of the neutron; Q - Bohr's model; R - gold foil experiment; S - discovery of the electron.
(a) P, Q, R, S (b) S, Q, R, P
(c) S, R, Q, P (d) R, S, P, Q
- Q14.** An atom has 15 electrons and 16 neutrons. In the standard notation ${}^A_ZX$, the values of A and Z are: [1]
(a) $A = 31, Z = 15$ (b) $A = 31, Z = 16$
(c) $A = 16, Z = 15$ (d) $A = 15, Z = 31$
- Q15.** Which statement best explains why Rutherford's model could not account for the stability of the atom? [1]
(a) The nucleus attracts the electrons very strongly. (b) The atom is mostly empty space.
(c) Neutrons had not been discovered. (d) A revolving electron keeps accelerating, so it should lose energy and spiral into the nucleus.
- Q16.** Chlorine has two isotopes, ${}^{35}\text{Cl}$ and ${}^{37}\text{Cl}$, in the ratio 3 : 1. The number of ${}^{37}\text{Cl}$ atoms in a sample of 2 million chlorine atoms is: [1]
(a) 5,00,000 (b) 15,00,000
(c) 7,50,000 (d) 2,50,000

SECTION B — Assertion-Reason Questions

4 questions × 1 mark = 4 marks. Choose: (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.

Q17. Assertion (A): Thomson's model could not explain why a few α -particles were scattered through large angles. [1]

Reason (R): In Thomson's model the positive charge is spread uniformly, so it cannot exert a force strong enough to reverse a fast α -particle.

Q18. Assertion (A): The atomic number uniquely identifies an element. [1]

Reason (R): A neutral atom has an equal number of protons and electrons.

Q19. Assertion (A): The valency of neon is 8. [1]

Reason (R): Neon has 8 electrons in its outermost shell.

Q20. Assertion (A): In Thomson's model the atom is electrically neutral. [1]

Reason (R): In this model the positive charge is concentrated at the centre of the atom.

SECTION C — Fill in the Blanks / True or False

5 questions × 1 mark = 5 marks.

Q21. Fill in the blank: The deflection of α -particles from their straight path in the gold foil experiment is called _____. [1]

Q22. Fill in the blank: The maximum number of electrons that the M-shell ($n = 3$) can accommodate is _____. [1]

Q23. Fill in the blank: The symbol Na for sodium is derived from its Latin name _____. [1]

Q24. True or False (correct the statement if false): An electron in the L-shell has less energy than an electron in the K-shell. [1]

Q25. True or False (correct the statement if false): Isobars are atoms of the same element having different mass numbers. [1]

SECTION D — Very Short Answer Questions

7 questions × 2 marks = 14 marks.

Q26. State **two** findings from Thomson's cathode ray tube experiments that led him to conclude that electrons are present in all atoms. [2]

Q27. (a) How does Thomson's model explain the electrical neutrality of an atom? [2]
(b) Name one experimental result that this model failed to explain.

Q28. Carbon has the electronic configuration 2, 4. Why does it not easily gain or lose electrons? [2]
How does it complete its octet and what is its valency?

Q29. (a) How does the energy of the shells K, L, M, N change as we move away from the nucleus? [2]
(b) What happens when an electron jumps from the M-shell to the L-shell?

Q30. Write the symbol with mass number of the isotope used as: (a) fuel in a nuclear power plant, [2]
(b) treatment of goitre/thyroid cancer, (c) radiation treatment of cancer, (d) finding the age of ancient fossils.

Q31. Write the symbols of potassium, silver, mercury and tungsten and name the language from which each symbol is derived. [2]

Q32. The diameter of an atom is $\approx 10^{-10}$ m and that of its nucleus $\approx 10^{-15}$ m. (a) Find the ratio of [2]
the diameter of the atom to that of the nucleus. (b) If the atom were as large as a 100 m wide cricket ground, what would be the approximate size of its nucleus?

SECTION E — Short Answer Questions

6 questions × 3 marks = 18 marks.

- Q33.** Rutherford's model had electrons revolving around the nucleus, just as Bohr's does. Why could Rutherford's model not explain the stability of the atom, and how did Bohr overcome this problem? [3]
- Q34.** (a) A helium atom has 2 protons, yet its mass is about 4 times that of hydrogen. Which particle explains this? Who discovered it and in which year? [3]
(b) Why do heavier atoms need many more neutrons than protons? Support your answer with one example.
- Q35.** The K and L shells of an atom Y are completely filled and its M-shell has 6 electrons. Its mass number is 32. Find (i) its atomic number, (ii) the number of neutrons, and (iii) its valency with a reason. [3]
- Q36.** Copper occurs in nature as ^{63}Cu and ^{65}Cu . If the average atomic mass of copper is 63.5 u, find the percentage abundance of each isotope. [3]
- Q37.** Distinguish between isotopes and isobars on any **three** points. Give one example of each. [3]
- Q38. Think like a scientist.** (a) Predict what you would observe in Rutherford's experiment if the gold foil were made much thicker, and give a reason. (b) Predict how the path of the particles would differ if the α -particles were replaced by negatively charged particles. [3]

SECTION F — Long Answer Questions

3 questions × 5 marks = 15 marks.

- Q39.** Describe Rutherford's α -ray scattering (gold foil) experiment with a neat labelled diagram. State **three** observations and the conclusion drawn from each. [5]
- Q40.** Compare Thomson's, Rutherford's and Bohr's models of the atom in a table under the heads: (i) basic idea, (ii) experimental basis, (iii) main limitation. [5]
OR
State the rules proposed by Bohr and Bury for the distribution of electrons in shells. Write the electronic configuration and valency of elements with atomic numbers 12 and 17, and draw the Bohr diagram of any one of them.
- Q41.** (a) What are isotopes? Why do isotopes of an element have the same chemical properties but different physical properties? [5]
(b) Chlorine occurs as ^{35}Cl and ^{37}Cl in the ratio 3 : 1. Calculate its average atomic mass. What does the value obtained actually mean, given that no single atom can have a fractional mass?

SECTION G — Case-Based Questions

2 case studies × 4 marks = 8 marks.

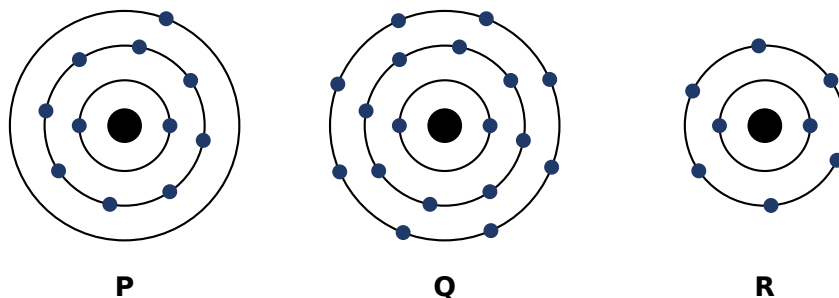
Q42. Case Study 1. The table gives the composition of neutral atoms of five elements P, Q, R, S and T (letters are not their real symbols).

[4]

Atom	Protons	Neutrons	Electrons
P	11	12	11
Q	12	12	12
R	11	14	11
S	18	22	18
T	20	20	20

- (i) Identify two atoms that are isotopes of each other and write their mass numbers. [1]
(ii) Identify two atoms that are isobars and justify. [1]
(iii) Write the electronic configuration of Q and its valency. [1]
(iv) S has the configuration 2, 8, 8. Why is it chemically unreactive? [1]

Q43. Case Study 2. A student drew Bohr diagrams for three neutral atoms P, Q and R.

[4]

- (i) Write the atomic numbers of P and R. [1]
(ii) Which of the three is chemically inert? Give a reason. [1]
(iii) State the valency of P and R and whether each loses or gains electrons. [1]
(iv) In what ratio will P and R combine? Justify using valency. [1]

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