

CLASS 9 SCIENCE — CHAPTER 8

NCERT SOLUTIONS

Journey Inside the Atom

New NCERT *Exploration* Textbook | 2026–27

The chapter-end “Revise, Reflect, Refine” section contains **15 questions**.

Q1. Rutherford’s Gold Foil Experiment

Choose the correct statements:

- (i) The experiment clearly showed neutrons in the nucleus.
- (ii) The results disproved the plum-pudding model and led to the idea of a nucleus.
- (iii) Large deflection of a few alpha particles indicated that most mass and positive charge are packed into a tiny centre.
- (iv) Deflection showed electrons move around the nucleus.

 **Answer: (ii) and (iii)**

Explanation:

(i)  **Incorrect**

Rutherford's experiment did not discover neutrons. The neutron was discovered later by **James Chadwick**.

(ii)  **Correct**

The results could not be explained by Thomson's plum-pudding model and led Rutherford to propose a central nucleus.

(iii)  **Correct**

A few alpha particles were strongly deflected because they came close to the tiny, dense, positively charged nucleus.

(iv)  Incorrect

The gold foil experiment established the existence of the nucleus and showed that most of the atom is empty space. It did not explain the detailed arrangement of electrons.



Q2. Bohr's Atomic Model

State whether each statement is correct or incorrect.

(i) Electrons lose energy in fixed orbits and fall into the nucleus.

 Incorrect

Electrons in allowed stationary orbits do not lose energy.

(ii) Electrons can exist anywhere around the nucleus with no fixed energy.

 Incorrect

Bohr proposed definite energy levels or shells.

(iii) Electrons revolve in fixed-energy orbits without losing energy.

 Correct

Electrons in stationary energy levels do not lose energy.

(iv) Electrons can be found between energy levels.

 Incorrect

According to Bohr's model, electrons occupy specific allowed energy levels.

 **Answer:**

Only (iii) is correct.



Q3. Isotopes and Isobars

Three atomic species contain:

- **X:** 18 protons, 19 neutrons
- **Y:** 17 protons, 18 neutrons
- **Z:** 17 protons, 20 neutrons

Find the relationship between:

(i) Y and Z

For Y:

Mass number = $17 + 18$

= **35**

For Z:

Mass number = $17 + 20$

= **37**

Both have:

Atomic number = 17

But their mass numbers are different.

 **Y and Z are isotopes.**

(ii) Z and X

For Z:

Mass number = $17 + 20$

= **37**

For X:

Mass number = $18 + 19$

= **37**

They have the **same mass number** but different atomic numbers.

✓ Z and X are isobars.

★ Answer:

Y and Z → Isotopes

Z and X → Isobars

Q4. Rutherford's Conclusion About the Positive Part of the Atom

Question:

What conclusion did Rutherford draw from the few alpha particles that bounced back or were strongly deflected?

Answer:

Rutherford concluded that:

- The positive charge of an atom is concentrated in a **very small central region**.
- This region is called the **nucleus**.
- The nucleus is **extremely small and dense**.
- It contains almost all the **positive charge**.
- It contains most of the **mass of the atom**.

The strong deflection of a few alpha particles occurred when they came very close to this positively charged nucleus.

★ **Conclusion:**

The atom has a tiny, dense, positively charged nucleus surrounded by mostly empty space.

Q5. Development of Atomic Models

Arrange the following in chronological order:

- (i) Bohr's fixed-energy orbits
- (ii) Thomson's plum-pudding model
- (iii) Rutherford's dense central nucleus
- (iv) Dalton's indivisible atom

✓ **Correct order:**

Dalton → Thomson → Rutherford → Bohr

1 Dalton's model

Atom was considered an **indivisible particle**.

2 Thomson's model

Atom was considered a positively charged sphere containing electrons.

3 Rutherford's model

Atom had a tiny, dense, positively charged nucleus and mostly empty space.

4 Bohr's model

Electrons occupy **fixed energy levels/shells**.

✓ **Answer:**

(iv) → (ii) → (iii) → (i)

Q6. Why Don't Electrons Fly Away?

Question:

Electrons move around the nucleus. Why do they not fly away from the atom?

Answer:

Electrons have a **negative charge**, while the nucleus has a **positive charge**.

Opposite charges attract each other.

Therefore, an **electrostatic force of attraction** exists between the nucleus and electrons.

This attraction keeps electrons bound to the atom.

In Bohr's model, electrons occupy allowed energy levels around the nucleus.

★ **Answer:**

Electrostatic attraction between the positively charged nucleus and negatively charged electrons keeps electrons bound to the atom.

Q7. Assertion and Reason

Assertion (A):

Discovery of subatomic particles helped in understanding atomic structure.

Reason (R):

Number of electrons is equal to number of protons in an atom.

✓ **Answer:**

(ii) Both A and R are true, but R is not the correct explanation of A.

Explanation:

The discovery of:

- Electron
- Proton
- Neutron

showed that atoms have an internal structure.

The equality of electrons and protons in a neutral atom explains **electrical neutrality**, but it does not explain how the discovery of subatomic particles helped reveal atomic structure.

★ **Answer:**

Both A and R are true, but R is not the correct explanation of A.



Q8. Magnesium Atom

Magnesium has:

Mass number = 24

Atomic number = 12

Find:

1. Protons
 2. Neutrons
 3. Electrons
 4. Electronic arrangement
-

(i) Number of protons

Atomic number = number of protons.

Therefore:

Protons = 12

(ii) Number of neutrons

Formula:

Neutrons = Mass number – Atomic number

= 24 – 12

= 12

(iii) Number of electrons

For a neutral atom:

Electrons = Protons

Therefore:

Electrons = 12

(iv) Electronic configuration

12 electrons are arranged as:

2, 8, 2

So:

K shell = 2

L shell = 8

M shell = 2

 **Answer:**

Protons = 12

Neutrons = 12

Electrons = 12

Electronic configuration = 2, 8, 2



Q9. Identify the Elements

For the elements shown in **Fig. 8.17**, find:

1. Name
2. Symbol

3. Total electrons
4. Valence electrons
5. Valency
6. Protons
7. Atomic number

The four figures correspond to the following elements.

(a) Lithium

Name: Lithium

Symbol: Li

Electrons: 3

Valence electrons: 1

Valency: 1

Protons: 3

Atomic number: 3

(b) Nitrogen

Name: Nitrogen

Symbol: N

Electrons: 7

Valence electrons: 5

Valency: 3

Protons: 7

Atomic number: 7

(c) Aluminium

Name: Aluminium

Symbol: Al

Electrons: 13

Valence electrons: 3

Valency: 3

Protons: 13

Atomic number: 13

(d) Fluorine

Name: Fluorine

Symbol: F

Electrons: 9

Valence electrons: 7

Valency: 1

Protons: 9

Atomic number: 9



Quick Table

Element	Symbol	Electron s	Valence e ⁻	Valency	Proton s	Atomic No.
Lithium	Li	3	1	1	3	3
Nitrogen	N	7	5	3	7	7
Aluminium	Al	13	3	3	13	13
Fluorine	F	9	7	1	9	9



Q10. Rutherford Model vs Bohr Model

Question:

Both Rutherford's and Bohr's models have electrons orbiting the nucleus. Why did Rutherford's model fail to explain atomic stability while Bohr's model succeeded?

Rutherford's problem:

According to classical physics, an electron moving in a circular path is an **accelerating charged particle**.

An accelerating charged particle should lose energy.

Therefore, the electron would:

- ↓ Lose energy
- ↓ Spiral inward
- ↓ Eventually fall into the nucleus

This would make atoms unstable.

Bohr's solution:

Bohr proposed that electrons occupy **fixed energy levels**.

Electrons in these allowed stationary states:

Do not lose energy.

Electrons can move from one energy level to another only by absorbing or releasing a specific amount of energy.

✓ Answer:

Rutherford's model could not explain atomic stability because orbiting electrons should continuously lose energy. Bohr's model explained stability by proposing fixed-energy stationary orbits in which electrons do not lose energy.



Q11. Find the Number of Neutrons

Question:

An atom has:

Mass number = 70

Electrons = 31

Find the number of neutrons.

For a neutral atom:

Electrons = Protons

Therefore:

Protons = **31**

Formula:

Neutrons = Mass number – Protons

= 70 – 31



Neutrons = 39



Q12. Atom with 79 Protons

An atom has:

Protons = 79

Mass number = 197

Find:

1. Neutrons
2. Electrons

(i) Neutrons

Formula:

$$\text{Neutrons} = \text{Mass number} - \text{Protons}$$

$$= 197 - 79$$

$$= 118$$

(ii) Electrons

For a neutral atom:

$$\text{Electrons} = \text{Protons}$$

Therefore:

$$\text{Electrons} = 79$$

✓ **Answer:**

$$\text{Neutrons} = 118$$

$$\text{Electrons} = 79$$



Q13. Complete the Table

(a)

Given:

$$\text{Atomic number} = 5$$

$$\text{Mass number} = 6$$

Protons:

= Atomic number

$$= 5$$

Electrons:

$$= 5$$

Neutrons:

$$= 6 - 5$$

$$= 1$$

Element with atomic number 5:

Boron (B)

(b)

Given:

Mass number = 14

Electrons = 7

Element = Nitrogen

For neutral nitrogen:

Protons = Electrons = **7**

Atomic number = **7**

Neutrons:

$$14 - 7$$

$$= 7$$

Answer:

Atomic number = 7

Mass number = 14

Protons = 7

Neutrons = 7

Electrons = 7

Element = Nitrogen

(c)

Given:

Mass number = 24

Protons = 12

Atomic number = **12**

Electrons = **12**

Neutrons:

$24 - 12$

= 12

Element:

Magnesium

(d)

Given:

Atomic number = 15

Neutrons = 16

Protons = **15**

Electrons = **15**

Mass number:

15 + 16

= **31**

Element:

Phosphorus

(e)

Given:

Mass number = 1

Neutrons = 0

Protons:

1 - 0

= **1**

Atomic number = **1**

Electrons = **1**

Element:

Hydrogen



Complete Table

	Atomic No.	Mass No.	Protons	Neutrons	Electrons	Element
(a)	5	6	5	1	5	Boron
(b)	7	14	7	7	7	Nitrogen
(c)	12	24	12	12	12	Magnesium

(d)	15	31	15	16	15	Phosphorus
(e)	1	1	1	0	1	Hydrogen



Q14. Identify Element X

Element X has:

Mass number = 35

Neutrons = 18

Find:

1. Electrons and protons
 2. Atomic number
 3. Element
 4. Electronic configuration
 5. Valence electrons
 6. Mass number after adding two neutrons
 7. Relation between X and the new atom
-

Step 1: Find protons

Formula:

Mass number = Protons + Neutrons

Therefore:

Protons = $35 - 18$

= 17

For a neutral atom:

Electrons = Protons

Electrons = 17

Step 2: Atomic number

Atomic number = Number of protons

$$Z = 17$$

Step 3: Identify element

Atomic number 17 is:

Chlorine (Cl)

Step 4: Electronic configuration

17 electrons:

2, 8, 7

Step 5: Valence electrons

Outer shell contains:

7 electrons

Step 6: Add two neutrons

Original mass number = 35

New mass number:

$$35 + 2$$

$$= 37$$

Step 7: Relation

Number of protons remains 17.

Atomic number remains unchanged.

Mass number changes from 35 to 37.

Therefore:

✓ **The new atom is an isotope of chlorine.**

★ **Answer:**

- Protons = **17**
- Electrons = **17**
- Atomic number = **17**
- Element = **Chlorine**
- Electronic configuration = **2, 8, 7**
- Valence electrons = **7**
- New mass number = **37**
- Relation = **Isotopes**

Q15. Hypothetical Electrons

An atom contains:

12 protons

12 neutrons

Imagine replacing all electrons with hypothetical particles that:

- Have the same charge as electrons
- Have **500 times greater mass**

What happens to:

1. Atomic number
2. Atomic mass

3. Mass number
 4. Overall charge
-

(i) Atomic number

Atomic number depends only on the number of **protons**.

Protons remain 12.

 **Atomic number remains 12.**

(ii) Atomic mass

The replacement particles are much heavier than normal electrons.

Therefore:

 **Atomic mass increases.**

Normally, electron mass is considered negligible, but here the particles are 500 times heavier.

(iii) Mass number

Mass number is:

Mass number = Protons + Neutrons

= 12 + 12

= 24

The number of protons and neutrons has not changed.

 **Mass number remains 24.**

(iv) Overall charge

The hypothetical particles have the **same charge as electrons**.

Therefore:

12 positive proton charges are balanced by 12 negative electron-like charges.

✓ **Overall charge remains zero.**

★ **Final Answer:**

Quantity	What happens?
Atomic number	Remains 12
Atomic mass	Increases
Mass number	Remains 24
Overall charge	Remains zero

CHAPTER 8 — COMPLETE ANSWER KEY

Q	Answer
1	(ii), (iii)
2	(iii) only
3	Y & Z → Isotopes ; Z & X → Isobars
4	Positive charge and most mass concentrated in tiny dense nucleus
5	Dalton → Thomson → Rutherford → Bohr
6	Electrostatic attraction keeps electrons bound
7	(ii)
8	12 p, 12 n, 12 e; configuration 2,8,2
9	Li, N, Al, F with values given above

- 10 Bohr's fixed energy levels explained atomic stability
- 11 39 neutrons
- 12 118 neutrons, 79 electrons
- 13 B, N, Mg, P, H table as above
- 14 Chlorine; configuration **2,8,7**; new mass number **37**; isotopes
- 15 Atomic number unchanged; atomic mass increases; mass number and charge unchanged

The supplied textbook answer key confirms the key Chapter 8 results, including Q1, Q2, Q3, Q7–Q15.

CHAPTER 8 — IMPORTANT FORMULAS & RELATIONSHIPS

Atomic Number

Z = Number of protons

Mass Number

A = Number of protons + Number of neutrons

Number of Neutrons

Neutrons = $A - Z$

Neutral Atom

Number of electrons = Number of protons

Isotopes

Same atomic number + different mass numbers

Isobars

Same mass number + different atomic numbers

Maximum electrons in a shell

Maximum electrons = $2n^2$

where n = shell number.

Most Important:

$$Z = p$$

$$A = p + n$$

$$n = A - Z$$

For a neutral atom: $e = p$