

Atoms, Molecules and Structure of the Atom

Science · Class 9 · Topic-wise Practice Worksheet

TIME 45 minutes	QUESTIONS 18	TOTAL MARKS 24	MAX. SCORE ____ / 24
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Name: _____ Class/Sec: _____ Date: _____

INSTRUCTIONS

- There are **18 questions** in this worksheet. All questions are compulsory.
- Each question has four options (A), (B), (C) and (D). Exactly **one** option is correct.
- Questions 1–15 carry **1 mark** each. Questions 16–18 (Achievers Section) carry **3 marks** each.
- There is no negative marking. Study every diagram and table carefully.

Section A — Scientific Reasoning

Q1–Q8 · 1 mark each

- The law of conservation of mass states that in a chemical reaction, mass is _____.
 (A) Created (B) Destroyed
 (C) Neither created nor destroyed (D) Converted into energy
- The atomic number of an element is equal to the number of _____ in its atom.
 (A) Electron shells (B) Neutrons
 (C) Protons and neutrons together (D) Protons
- Isotopes of an element have _____.
 (A) The same mass number but different atomic numbers (B) The same atomic number but different mass numbers
 (C) Different numbers of electrons (D) Different chemical properties
- Which subatomic particle carries **no** charge?
 (A) Proton (B) Electron
 (C) Nucleus (D) Neutron
- The molecular mass of water (H_2O) is _____. (H = 1 u, O = 16 u)
 (A) 18 u (B) 17 u
 (C) 16 u (D) 20 u
- An element has the electronic configuration 2, 8, 1. Its valency is _____.
 (A) 1 (B) 2
 (C) 7 (D) 8
- In Rutherford's α -particle scattering experiment, the fact that a very few particles bounced straight back showed that an atom has _____.
 (A) Electrons embedded in a positive sphere (B) A small, dense, positively charged nucleus
 (C) Equal numbers of protons and neutrons (D) No empty space inside it

8. The number of particles present in one mole of any substance is _____.

(A) 3.011×10^{23}

(B) 6.022×10^{-23}

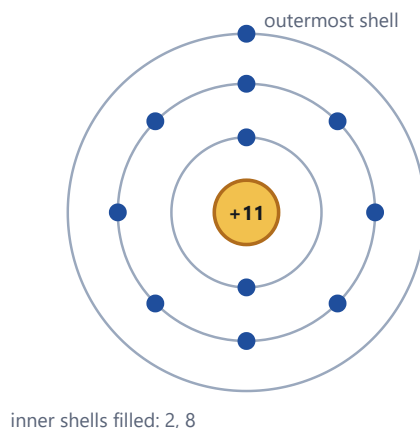
(C) 6.022×10^{23}

(D) 1.66×10^{-24}

Section B — Applying What You Know

Q9–Q15 · 1 mark each

9. The diagram shows the shell structure of an atom X. Which statement about X is correct?



Shell structure of atom X (nuclear charge +11)

(A) X has 7 valence electrons and gains one electron

(B) X has a mass number of 11

(C) X is a noble gas with a complete outer shell

(D) X has 1 valence electron and loses it to form a positive ion

10. The chemical formula of calcium chloride is _____.



11. The mass of 0.5 mole of carbon dioxide (CO_2) is _____. (C = 12 u, O = 16 u)

(A) 11 g

(B) 22 g

(C) 44 g

(D) 88 g

12. One row of the table below is **incorrectly** matched. Which row is it?

Row	Species	Description
(A)	Neutron	Negatively charged particle in the nucleus
(B)	Ca^{2+}	Calcium atom that has lost two electrons
(C)	Protium and deuterium	Isotopes of hydrogen
(D)	Argon (Z = 18)	Has a completely filled outermost shell

Table 2.1 — Particles and species

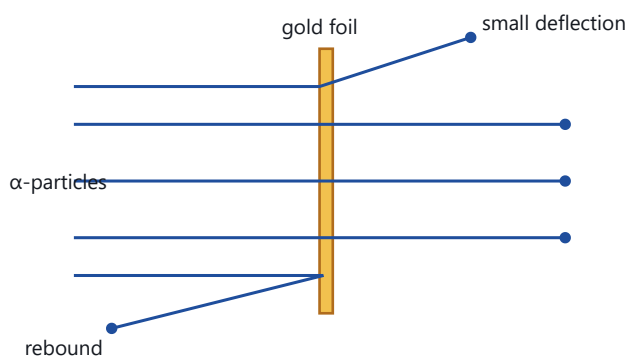
(A) (A)

(B) (B)

(C) (C)

(D) (D)

13. In the α -particle scattering experiment shown, most particles passed straight through the gold foil. This observation shows that _____.



Paths of α -particles fired at a thin gold foil

- (A) The atom is a solid sphere throughout
(B) Electrons are heavier than α -particles
(C) Most of the space inside an atom is empty
(D) The nucleus is negatively charged
14. An atom of carbon-14 has mass number 14 and atomic number 6. The number of neutrons in it is _____.
(A) 6
(B) 8
(C) 14
(D) 20
15. Samples of pure water taken from a river, a well and a laboratory each contain hydrogen and oxygen in the mass ratio 1 : 8. This illustrates the law of _____.
(A) Conservation of mass
(B) Gaseous volumes
(C) Multiple proportions
(D) Constant proportions

Achievers Section

Q16–Q18 · 3 marks each

16. **Assertion (A):** The atomic mass of chlorine is 35.5 u, although no single chlorine atom has that mass.
Reason (R): Naturally occurring chlorine is a mixture of two isotopes, and the value quoted is their weighted average.
- (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
17. The number of molecules present in 22 g of carbon dioxide is _____. (C = 12 u, O = 16 u)
(A) 3.011×10^{23}
(B) 6.022×10^{23}
(C) 1.204×10^{24}
(D) 22×10^{23}
18. Element P has atomic number 17 and element Q has atomic number 11. The formula of the compound they form, and the type of bonding in it, are _____.
(A) PQ, covalent
(B) QP, ionic
(C) QP_2 , ionic
(D) Q_2P , covalent

Answer Key

1	C	2	D	3	B	4	D	5	A
6	A	7	B	8	C	9	D	10	A
11	B	12	A	13	C	14	B	15	D
16	A	17	A	18	B				

Solutions

1. Answer: (C) Neither created nor destroyed

In an ordinary chemical reaction the atoms are only rearranged, so the total mass of the products equals the total mass of the reactants — mass is **neither created nor destroyed**. This is why chemical equations must be balanced.

2. Answer: (D) Protons

The atomic number Z counts the **protons** in the nucleus, and it is what fixes the identity of the element. The mass number counts protons and neutrons together.

3. Answer: (B) The same atomic number but different mass numbers

Isotopes are atoms of the same element, so they have **the same atomic number but different mass numbers** — they differ only in the number of neutrons. Their chemical behaviour is essentially identical because that depends on the electrons.

4. Answer: (D) Neutron

The **neutron** is electrically neutral. The proton carries a positive charge and the electron an equal negative charge, and an atom is neutral overall because the two are present in equal numbers.

5. Answer: (A) 18 u

Two hydrogen atoms contribute $2 \times 1 = 2$ u and one oxygen atom 16 u, giving $2 + 16 = \mathbf{18}$ u.

6. Answer: (A) 1

The outermost shell holds a single electron, and losing it gives the stable configuration 2, 8. So the valency is **1**. (This configuration belongs to sodium, $Z = 11$.)

7. Answer: (B) A small, dense, positively charged nucleus

A head-on rebound requires a collision with something both heavy and strongly positive, yet such rebounds were extremely rare. Rutherford concluded that all the positive charge and nearly all the mass sit in **a tiny dense nucleus**, with the rest of the atom mostly empty space.

8. Answer: (C) 6.022×10^{23}

One mole always contains Avogadro's number of particles, **6.022×10^{23}** , whether those particles are atoms, molecules or ions.

9. Answer: (D) X has 1 valence electron and loses it to form a positive ion

The nucleus carries +11, so the atom has 11 electrons arranged 2, 8, 1 — the drawing shows two filled inner shells and a single electron in the outermost one. Losing that one electron gives the stable 2, 8 arrangement, so **X loses one electron to form a positive ion**. The +11 is the atomic number, not the mass number.

10. Answer: (A) CaCl_2

Calcium has valency 2 and chlorine valency 1, so two chloride ions are needed to balance one calcium ion: **CaCl_2** . Crossing over the valencies is the quickest way to write such formulae.

11. Answer: (B) 22 g

The molar mass of CO_2 is $12 + (2 \times 16) = 44$ g per mole, so half a mole has mass $0.5 \times 44 = \mathbf{22}$ g.

12. Answer: (A) (A)

The neutron sits in the nucleus but carries *no* charge at all, so row **(A)** is wrong. The other rows are correct: protium and deuterium differ only in neutrons, Ca^{2+} is calcium minus two electrons, and argon's configuration 2, 8, 8 is complete.

13. Answer: (C) Most of the space inside an atom is empty

If the atom were solid throughout, every α -particle would be deflected. Because nearly all of them sailed straight through undeviated, **most of the atom must be empty space**. The rare large deflections were what revealed the tiny positive nucleus.

14. Answer: (B) 8

Number of neutrons = mass number – atomic number = $14 - 6 = \mathbf{8}$. The atom also has 6 protons and 6 electrons.

15. Answer: (D) Constant proportions

The law of **constant proportions** (definite proportions) says a given compound always contains the same elements in the same fixed ratio by mass, whatever its source. Conservation of mass instead compares reactants with products.

16. Answer: (A) Both A and R are true and R is the correct explanation of A

Chlorine occurs as Cl-35 and Cl-37 in roughly a 3 : 1 ratio, giving an average of $(3 \times 35 + 1 \times 37) \div 4 = 35.5$ u. Every individual atom has mass 35 u or 37 u, never 35.5 u. Both statements are true and the isotope mixture is exactly **why** the average is fractional.

17. Answer: (A) 3.011×10^{23}

The molar mass of CO₂ is 44 g, so 22 g is $22 \div 44 = 0.5$ mole. Multiplying by Avogadro's number, the sample holds $0.5 \times 6.022 \times 10^{23} = \mathbf{3.011 \times 10^{23}}$ molecules (though it contains three times as many atoms).

18. Answer: (B) QP, ionic

P (Z = 17) has the configuration 2, 8, 7 and needs one electron; Q (Z = 11) has 2, 8, 1 and gives one away. Q transfers its single outer electron to P, so they combine in a 1 : 1 ratio as **QP with ionic bonding** — this is sodium chloride, NaCl.