



Class 9 Science Chapter 9 – Important Questions



Atomic Foundations of Matter



New NCERT *Exploration* | 2026–27

Chapter 9 covers the laws of chemical combination, Dalton's atomic theory, atoms and molecules, covalent and ionic compounds, ions, chemical formulae, molecular mass and formula unit mass.



SECTION A – VERY SHORT ANSWER QUESTIONS

1. What is the Law of Conservation of Mass?
2. Who proposed the Law of Conservation of Mass?
3. What is the Law of Constant Proportions?
4. Who proposed Dalton's atomic theory?
5. What is an atom?
6. What is a molecule?
7. What is a compound?
8. What is a chemical bond?
9. What is a covalent bond?
10. What is an ionic bond?

11. What is an ion?
 12. What is a cation?
 13. What is an anion?
 14. What is valency?
 15. What is a polyatomic ion?
 16. What is molecular mass?
 17. What is formula unit mass?
 18. What is the difference between a molecule and a formula unit?
 19. Why do atoms combine to form compounds?
 20. What is meant by chemical combination?
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SECTION B – LAWS OF CHEMICAL COMBINATION

21. State the Law of Conservation of Mass.
22. Explain the Law of Conservation of Mass with an example.
23. Why does the total mass remain unchanged during a chemical reaction in a closed system?
24. Why may the measured mass appear to decrease when a reaction produces a gas in an open container?
25. State the Law of Constant Proportions.
26. Explain the Law of Constant Proportions using water as an example.

27. Why does a pure compound always contain its elements in a fixed ratio by mass?

28. How are the laws of chemical combination useful in understanding compounds?

29. Differentiate between the Law of Conservation of Mass and the Law of Constant Proportions.

30. How did these laws contribute to the development of Dalton's atomic theory?

The chapter demonstrates conservation of mass experimentally and states that matter is neither created nor destroyed in a chemical reaction.



SECTION C – DALTON'S ATOMIC THEORY

31. State the main postulates of Dalton's atomic theory.

32. How did Dalton explain the formation of compounds?

33. According to Dalton, why do atoms combine in whole-number ratios?

34. How does Dalton's theory explain the Law of Conservation of Mass?

35. How does Dalton's theory explain the Law of Constant Proportions?

36. Why was Dalton's theory important in the development of chemistry?

37. Which ideas of Dalton's atomic theory are still useful today?

38. Which parts of Dalton's original theory were modified after the discovery of subatomic particles?

39. Why can atoms of the same element have different masses?

40. Why can atoms combine in different ratios to form different compounds?



SECTION D – ATOMS, MOLECULES & COMPOUNDS

41. Differentiate between an atom and a molecule.

42. Differentiate between an element and a compound.

43. What is a molecule of an element?

44. Give examples of molecules containing two atoms of the same element.

45. What is a molecule of a compound?

46. Give examples of molecules of compounds.

47. Why is oxygen represented as O₂ rather than simply O when describing ordinary oxygen gas?

48. What is meant by a diatomic molecule?

49. Give examples of polyatomic molecules.

50. Why do compounds have properties different from those of their constituent elements?

The chapter uses water to illustrate that a compound can have properties very different from those of the elements from which it is formed.



SECTION E – COVALENT BONDING

51. What is a covalent bond?

- 52. How is a covalent bond formed?**
 - 53. Why do atoms share electrons?**
 - 54. What is a single covalent bond?**
 - 55. What is a double covalent bond?**
 - 56. What is a triple covalent bond?**
 - 57. Give an example of a molecule containing a single covalent bond.**
 - 58. Give an example of a molecule containing a double covalent bond.**
 - 59. Give an example of a molecule containing a triple covalent bond.**
 - 60. Explain the formation of the hydrogen molecule.**
 - 61. Explain the formation of the oxygen molecule.**
 - 62. Explain the formation of the nitrogen molecule.**
 - 63. How does covalent bonding help atoms achieve stable electronic configurations?**
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SECTION F – IONIC BONDING

- 64. What is an ionic bond?**
- 65. How is an ionic bond formed?**
- 66. What is a cation?**
- 67. What is an anion?**
- 68. Why does sodium form Na^+ ?**
- 69. Why does chlorine form Cl^- ?**

- 70. Explain the formation of sodium chloride.
 - 71. Why are ionic compounds electrically neutral overall?
 - 72. What is meant by electrostatic attraction between ions?
 - 73. Differentiate between ionic and covalent bonding.
 - 74. Why do metals generally form positive ions?
 - 75. Why do non-metals generally form negative ions?
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SECTION G – IONS & VALENCY

- 76. What is an ion?
- 77. What is a monatomic ion?
- 78. What is a polyatomic ion?
- 79. Write the formula and valency of hydroxide ion.
- 80. Write the formula and valency of nitrate ion.
- 81. Write the formula and valency of carbonate ion.
- 82. Write the formula and valency of sulfate ion.
- 83. Write the formula and valency of ammonium ion.
- 84. What is the charge on a sodium ion?
- 85. What is the charge on a magnesium ion?
- 86. What is the charge on an aluminium ion?
- 87. What is the charge on an oxide ion?

88. What is the charge on a chloride ion?

89. Why must the total positive and negative charges balance in an ionic compound?

The chapter's ion table includes common ions such as OH^- , NO_3^- , HCO_3^- , CO_3^{2-} , SO_4^{2-} and NH_4^+ , along with their valencies.



SECTION H – WRITING CHEMICAL FORMULAE

90. What information is required to write the formula of a compound?

91. State the steps for writing the formula of a covalent compound.

92. State the steps for writing the formula of an ionic compound.

93. What is the criss-cross method?

94. Why are subscripts used in chemical formulae?

95. Why is the subscript 1 not written?

96. Write the formula of hydrogen chloride.

97. Write the formula of hydrogen sulfide.

98. Write the formula of carbon tetrachloride.

99. Write the formula of magnesium chloride.

100. Write the formula of aluminium oxide.

101. Write the formula of sodium oxide.

102. Write the formula of calcium chloride.

103. Write the formula of magnesium hydroxide.

104. Write the formula of sodium sulfate.

105. Write the formula of calcium carbonate.

106. Write the formula of ammonium sulfate.

The textbook explicitly gives the valency/crossover procedure for writing covalent formulae and instructs that the **cation is written first, followed by the anion** for ionic compounds.



SECTION I – FORMULA-WRITING PRACTICE

Write the chemical formulae of:

107. Magnesium and nitrogen

108. Lithium and nitrogen

109. Sodium and sulfur

110. Aluminium and oxygen

111. Calcium and oxygen

112. Magnesium and oxygen

113. Aluminium and chlorine

114. Calcium and hydroxide

115. Sodium and carbonate

116. Magnesium and sulfate

117. Aluminium and sulfate

118. Ammonium and nitrate

119. Calcium and phosphate

120. Aluminium and phosphate

The chapter-end material specifically asks students to write formulae for combinations such as magnesium + nitrogen, lithium + nitrogen, sodium + sulfur and aluminium + oxygen.

SECTION J – PROPERTIES OF IONIC & COVALENT COMPOUNDS

121. What are the general properties of ionic compounds?

122. What are the general properties of covalent compounds?

123. Why do ionic compounds generally have high melting and boiling points?

124. Why do ionic compounds conduct electricity in the molten state?

125. Why do ionic compounds conduct electricity when dissolved in water?

126. Why do ionic compounds generally not conduct electricity in the solid state?

127. Why do covalent compounds generally have low melting and boiling points?

128. Why do most covalent compounds not conduct electricity?

129. Differentiate between ionic and covalent compounds on the basis of:

- Bond formation
- Structure
- Melting point
- Boiling point
- Electrical conductivity

130. A compound does not conduct electricity in the solid state but conducts electricity when dissolved in water. What type of compound is it likely to be? Explain.

The textbook specifically connects ionic compounds with strong inter-ionic attractions and explains their electrical conductivity in appropriate states.



SECTION K – MOLECULAR MASS

131. What is molecular mass?

132. How is molecular mass calculated?

133. What is the atomic mass of hydrogen?

134. What is the atomic mass of carbon?

135. What is the atomic mass of oxygen?

136. Calculate the molecular mass of H₂O.

137. Calculate the molecular mass of CO₂.

138. Calculate the molecular mass of NH₃.

139. Calculate the molecular mass of CH₄.

140. Calculate the molecular mass of HNO₃.

141. Calculate the molecular mass of H₂SO₄.

142. Calculate the molecular mass of C₂H₅OH.

143. Why is molecular mass used for covalent compounds?

The textbook calculates molecular mass by **adding the masses of all atoms present in a molecule**, giving H₂O = 18 u and CO₂ = 44 u as examples.



SECTION L – FORMULA UNIT MASS

144. What is a formula unit?
145. What is formula unit mass?
146. Why are formula units used for ionic compounds instead of molecules?
147. Calculate the formula unit mass of Na_2O .
148. Calculate the formula unit mass of NaCl .
149. Calculate the formula unit mass of MgCl_2 .
150. Calculate the formula unit mass of CaCO_3 .
151. Calculate the formula unit mass of Al_2O_3 .
152. Calculate the formula unit mass of Na_2SO_4 .
153. Differentiate between molecular mass and formula unit mass.

The chapter defines a **formula unit** as the simplest whole-number ratio of ions in an ionic compound and its mass as formula unit mass; Na_2O is given as an example with mass 62 u.



SECTION M – APPLICATION-BASED QUESTIONS

154. A student mixes hydrogen and oxygen to form water.
- a) What type of substance is water?
 - b) Does water have the same properties as hydrogen and oxygen?
 - c) Which law explains the fixed composition of water?
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155. Sodium loses one electron while chlorine gains one electron.

- a) What ions are formed?
 - b) What type of bond forms between them?
 - c) Write the formula of the compound formed.
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156. An element has valency 2 and combines with an element having valency 3.

- a) What method can be used to write the formula?
 - b) What would the simplest ratio of the atoms be?
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157. A compound contains calcium ions and carbonate ions.

- a) Write the charges/valencies of the ions.
 - b) Write the chemical formula.
 - c) Explain why the charges are balanced.
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158. A compound has molecular mass 44 u and contains carbon and oxygen.

- a) Identify the likely compound.
 - b) Write its formula.
 - c) Show the mass calculation.
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SECTION N – COMPETENCY-BASED QUESTIONS

159.  Case Study – Conservation of Mass

A student reacts vinegar and baking soda in a closed container with a balloon attached.

- a) What gas is produced?
- b) What happens to the balloon?
- c) Why does the total mass remain unchanged?
- d) Which law is demonstrated?

The textbook explains that when the gas is prevented from escaping, the final mass equals the initial mass, demonstrating conservation of mass.

160. Case Study – Constant Proportions

Two samples of pure water are obtained from different sources.

- a) Will the elements present be the same?
 - b) Will hydrogen and oxygen occur in a fixed proportion by mass?
 - c) Which law explains this?
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161. Case Study – Ionic Compound

Element M has two electrons in its valence shell and reacts with oxygen.

- a) What ion is M likely to form?
- b) What ion does oxygen form?
- c) Predict the formula of the compound.
- d) What type of bond is present?
- e) Would its aqueous solution conduct electricity?

A similar application is explicitly included in the textbook's "Pause and Ponder" questions.

162. Case Study – Molecular Mass

A compound has formula HNO_3 .

- a) Identify the number of atoms of each element.
 - b) Calculate its molecular mass.
 - c) State whether it is a molecular or ionic compound.
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SECTION O – HIGHER-ORDER THINKING QUESTIONS

163. Why does the mass remain conserved during a chemical reaction?

164. Why can the mass appear to change when a gas escapes from an open reaction vessel?

165. Why does a compound have properties different from its constituent elements?

166. Why did Dalton propose that atoms combine in simple whole-number ratios?

167. Why do atoms share electrons in covalent compounds?

168. Why do atoms transfer electrons during ionic bond formation?

169. Why are ionic compounds generally hard solids?

170. Why do ionic compounds conduct electricity only when ions are free to move?

171. Why do covalent compounds generally have lower melting points than ionic compounds?

172. Why must the total charge of a chemical formula be zero for a neutral ionic compound?

173. Why is Na_2O written instead of NaO ?

174. Why is CaCl_2 written instead of CaCl ?

175. Why is molecular mass calculated for H_2O but formula unit mass used for NaCl ?

176. Why can two elements form more than one compound?



SECTION P – LONG ANSWER QUESTIONS

177. Explain the Law of Conservation of Mass with an experiment.
178. Explain the Law of Constant Proportions with a suitable example.
179. Explain Dalton's atomic theory and relate it to the laws of chemical combination.
180. Explain the formation of a covalent bond with suitable examples.
181. Explain the formation of an ionic bond using sodium chloride.
182. Explain the difference between covalent and ionic compounds.
183. Explain ions, cations, anions and polyatomic ions with examples.
184. Explain the method of writing chemical formulae using valencies.
185. Explain molecular mass and formula unit mass with examples.
186. Describe the properties of ionic and covalent compounds.
187. Explain why compounds have properties different from the elements from which they are formed.
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MOST IMPORTANT QUESTIONS FOR EXAM

If students have limited time, prepare these **first**:

- ★ 1. State and explain the Law of Conservation of Mass.
- ★ 2. State and explain the Law of Constant Proportions.
- ★ 3. Explain Dalton's atomic theory.

- ★ 4. Explain the formation of a covalent bond.
 - ★ 5. Explain the formation of an ionic bond using NaCl.
 - ★ 6. Differentiate between ionic and covalent compounds.
 - ★ 7. Define cation, anion and polyatomic ion.
 - ★ 8. Write chemical formulae using valencies.
 - ★ 9. Calculate molecular mass of given covalent compounds.
 - ★ 10. Calculate formula unit mass of given ionic compounds.
 - ★ 11. Differentiate between molecular mass and formula unit mass.
 - ★ 12. Explain why ionic compounds conduct electricity in molten/aqueous states.
 - ★ 13. Explain why compounds have different properties from their constituent elements.
 - ★ 14. Solve application-based questions involving valency and formula writing.
 - ★ 15. Verify conservation of mass using given masses of reactants and products.
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IMPORTANT FORMULAS / RULES



Conservation of Mass

Total mass of reactants = Total mass of products



Molecular Mass

Molecular mass = Sum of atomic masses of all atoms in one molecule



Formula Unit Mass

Formula unit mass = Sum of atomic masses of all ions in one formula unit



Chemical Formula

Total positive charge = Total negative charge



Example

For H_2O :

$$\text{Molecular mass} = (2 \times 1) + (1 \times 16) = 18 \text{ u}$$

For Na_2O :

$$\text{Formula unit mass} = (2 \times 23) + (1 \times 16) = 62 \text{ u}$$

These are the same calculation methods demonstrated in the textbook.

QUICK REVISION BOX

 **Conservation of mass** → Mass of reactants = Mass of products

 **Constant proportions** → Elements in a pure compound occur in a fixed ratio by mass

 **Atom** → Smallest unit of an element participating in chemical changes

 **Covalent bond** → Formed by sharing electrons

 **Ionic bond** → Electrostatic attraction between oppositely charged ions

 **Cation** → Positively charged ion

 **Anion** → Negatively charged ion

 **Polyatomic ion** → Group of atoms carrying an overall charge

 **Molecular mass** → Mass of one molecule

 **Formula unit mass** → Mass of one formula unit of an ionic compound

 **Chemical formula** → Shows the elements and their simplest whole-number ratio

TOP NUMERICALS TO PRACTISE

1.  **Conservation of mass**
2.  **Constant proportions**
3.  **Molecular mass**
4.  **Formula unit mass**

5.  **Formula writing using valencies**
6.  **Balancing ionic charges**
7.  **Polyatomic ion formulae**
8.  **Finding unknown mass using conservation of mass**
9.  **Comparing composition of compounds**
10.  **Application-based chemical formula questions**

★ Exam Tip

For formula-writing questions, always follow:

Write symbols → Write valencies → Balance/cross the valencies → Simplify the ratio → Write the final formula

For numerical questions:

Write formula → Substitute values → Calculate → Add unit (u where appropriate).