1. **OBJECTIVE QUESTIONS**

1. A sample of pure water, irrespective of its source contains 11.1% hydrogen and 88.9% oxygen. The data supports
   (a) law of constant proportions
   (b) law of conservation of mass
   (c) law of reciprocal proportions
   (d) law of multiple proportions
   **Ans:** (a) law of constant proportions

   Water obtained from any source contains hydrogen and oxygen in the same proportion by mass. Hence, the data supports the law of constant proportions.

2. The formula of chloride of a metal M is MCl₃, then the formula of the phosphate of metal M will be
   (a) MPO₄
   (b) M₂PO₄
   (c) M₃PO₄
   (d) M₄(PO₄)₃
   **Ans:** (a) MPO₄

   ![Symbol Diagram]

<table>
<thead>
<tr>
<th>Symbol</th>
<th>M</th>
<th>PO₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valency</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Dividing by common factor</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Identify the correct statements.
   1. In a compound such as water, the ratio of the mass of hydrogen to the mass of oxygen is always 8:1.
   2. If 9 g of water is decomposed, 1 g of hydrogen and 8 g of oxygen are always obtained.
   3. In ammonia, nitrogen and hydrogen are always present in the ratio 3:14 by mass.
   4. Many compounds are composed of two or more elements and each such compound has the same elements in the same proportions.
      (a) 1 and 3
      (b) 1, 2 and 3
      (c) 2 and 4
      (d) All of these
   **Ans:** (c) 2 and 4

4. Which of the following is a triatomic molecule?
   (a) Carbon-di-oxide
   (b) Ammonia
   (c) Helium
   (d) Sugar
   **Ans:** (a) Carbon-di-oxide

   Carbon-di-oxide contains one atom of carbon and two atoms of oxygen.

5. The atomic mass of calcium (Ca) is 40 g. The number of moles in 60 g of calcium are
   (a) 0.5 mol
   (b) 2.0 mol
   (c) 1.5 mol
   (d) 0.75 mol
   **Ans:** (c) 1.5 mol

   \[
   \text{No. of moles} = \frac{\text{Given mass}}{\text{Molar mass}} = \frac{60}{40} = 1.5
   \]

6. All samples of carbon-di-oxide contain carbon and oxygen in the mass ratio 3 : 8. This is in agreement with the law of
   (a) conservation of mass
   (b) constant proportions
   (c) multiple proportions
   (d) gaseous volumes
   **Ans:** (b) constant proportions

   Law of constant proportions states that a chemical compound is always made up of the same elements combined together in the same fixed proportion by mass.

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7. What mass of carbon-dioxide (CO₂) will contain \(3.011 \times 10^{23}\) molecules?
   (a) 11.0 g
   (b) 22.0 g
   (c) 4.4 g
   (d) 44.0 g
   **Ans:** (b) 22.0 g

   \[6.022 \times 10^{23}\] molecules of \(\text{CO}_2\) corresponds to 44 g
   \[3.011 \times 10^{23}\] molecules of \(\text{CO}_2\) corresponds to \(= 22\) g

8. The number of atoms in \(\text{K}_2\text{Cr}_7\text{O}_{12}\) is
   (a) 9
   (b) 11
9. How many grams of H₂SO₄ are present in 0.25 mole of H₂SO₄?
(a) 2.45  (b) 24.5  (c) 0.245  (d) 0.25
Ans : (b) 24.5

Mass Number of moles Molar mass 
\[
\begin{align*}
\text{Mass} & = \text{Number of moles} \times \text{Molar mass} \\
& = 0.25 \times 98 = 24.5 \text{ g}
\end{align*}
\]

10. The number of atoms present in a molecule of a substance is called
(a) molecularity  (b) atomicity  (c) valency  (d) reactivity
Ans : (b) atomicity

11. The valency of nitrogen in ammonia (NH₃) is
(a) 2  (b) 0  (c) 3  (d) 4
Ans : (c) 3

\[
\begin{align*}
\text{N} & \quad \text{H} \\
\text{3} & \quad \text{1}
\end{align*}
\]

12. The mass of a molecule of water is
(a) \(3 \times 10^{-20}\) kg  (b) \(3 \times 10^{-25}\) kg  
(c) \(1.5 \times 10^{-28}\) kg  (d) \(2.5 \times 10^{-26}\) kg
Ans : (a) \(3 \times 10^{-20}\) kg
\[
\begin{align*}
\text{Mass} & = \frac{18}{6.022 \times 10^{23}} \\
& = 3 \times 10^{-23} \text{ g} \\
& = 3 \times 10^{-26} \text{ kg}
\end{align*}
\]

13. Select the incorrect match.
1. N₂O₄-Dinitrogen tetroxide  
2. HCl-Hydrogen chloride  
3. CO-Carbon dioxide  
4. PCl₅-Phosphorus trichloride
(a) 1 and 2  (b) 3 and 4  
(c) 1 and 3  (d) 2 and 4
Ans : (b) 3 and 4

CO - Carbon monoxide.  
PCl₅ - Phosphorus pentachloride.

14. Molecular mass is defined as the
(a) mass of one atom compared with the mass of one molecule  
(b) mass of one atom compared with the mass of one atom of hydrogen
\[\text{(c) mass of one molecule of any substance compared with the mass of one atom of C-12} \]
\[\text{(d) none of the above} \]
Ans : (c) mass of one molecule of any substance compared with the mass of one atom of C-12

15. Match the columns by choosing the correct option.

<table>
<thead>
<tr>
<th>Column I (Ion)</th>
<th>Column II (Nature)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Chloride ion</td>
<td>1. Divalent, negative</td>
</tr>
<tr>
<td>(B) Calcium ion</td>
<td>2. Trivalent, positive</td>
</tr>
<tr>
<td>(C) Aluminium ion</td>
<td>3. Divalent, positive</td>
</tr>
<tr>
<td>(D) Oxide ion</td>
<td>4. Monovalent, negative</td>
</tr>
</tbody>
</table>

(a) A – 4, B – 2, C – 1, D – 3 
(b) A – 4, B – 3, C – 2, D – 1 
(c) A – 3, B – 2, C – 1, D – 4 
(d) A – 1, B – 4, C – 3, D – 2
Ans : (b) A – 4, B – 3, C – 2, D – 1

Chloride ion – Cl⁻, Calcium ion – Ca²⁺, Aluminium ion – Al³⁺, Oxide ion – O²⁻

16. The molecular formula P₂O₅ means that
(a) a molecule contains 2 atoms of P and 5 atoms of O 
(b) the ratio of the mass of P to the mass of O in the molecule is 2 : 5 
(c) there are twice as many P atoms in the molecule as there are O atoms 
(d) the ratio of the mass of P to the mass of O in the molecule is 5 : 2.
Ans : (a) a molecule contains 2 atoms of P and 5 atoms of O
Molecular formula represents the actual number of atoms of different elements present in one molecule of the compound.

17. An atom is the
(a) smallest particle of matter known 
(b) smallest particle of a gas 
(c) smallest particle of an element that can take part in a chemical change 
(d) radioactive emission
Ans : (c) smallest particle of an element that can take part in a chemical change

18. Atomicity of sulphur is
(a) 8  (b) 4  
(c) 2  (d) 1
Ans : (a) 8
Sulphur exists as S₈ molecule.

19. Which of the following represents a polyatomic ion?
(a) Sulphide  (b) Chloride 
(c) Sulphate  (d) Nitride
Ans : (c) Sulphate
Sulphate (SO₄²⁻) ion consists of group of atoms. Sulphate is a polyatomic ion.
20. Valency of silver in Ag₂S is
   (a) 1  (b) 2  (c) 0  (d) 3
   **Answer:** (a) 1

21. 52 g of He contains
   (a) 4 × 6.022 × 10²³ atoms
   (b) 13 atoms
   (c) 13 × 6.022 × 10²³ atoms
   (b) 4 atoms
   **Answer:** (c) 13 × 6.022 × 10²³ atoms

22. How many elements are present in one formula unit of Al(OH)₃?
   (a) 3  (b) 4  (c) 5  (d) 6
   **Answer:** (a) 3
   One formula unit of Al(OH)₃ contains aluminium, oxygen and hydrogen.

23. A chemical equation is always balanced to fulfil the condition of
   (a) Dalton’s atomic theory
   (b) law of constant composition
   (c) law of multiple proportions
   (d) law of conservation of mass
   **Answer:** (d) law of conservation of mass
   A chemical equation is always balanced to fulfil the condition of law of conservation of mass. According to this law, the total mass of the reactants is equal to the total mass of the products.

24. Some elements along with their symbols are enlisted in the given table:

<table>
<thead>
<tr>
<th>Elements</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Argon-Ar</td>
<td>2. Iron-I</td>
<td></td>
</tr>
<tr>
<td>3. Chlorine-Cl</td>
<td>4. Lead-Pb</td>
<td></td>
</tr>
<tr>
<td>5. Gold-Au</td>
<td>6. Magnesium-Ma</td>
<td></td>
</tr>
<tr>
<td>7. Potassium-P</td>
<td>8. Sodium-S</td>
<td></td>
</tr>
<tr>
<td>9. Zinc-Zn</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identify the incorrect representation of symbols.
(a) 4, 5 and 6  (b) 1, 2, 4, 5 and 9

25. Chemical formula of ferric oxide is
   (a) FeO  (b) Fe₂O₃
   (c) Fe₃O₄  (d) none of these
   **Answer:** (b) Fe₂O₃

Hence,
   Chemical formula = Fe₂O₃

26. Identify the incorrect statement.
   (a) The building blocks of all matter are atoms.
   (b) Atoms are very small. They cannot be seen by the naked eye.
   (c) The size of an atom is expressed in metres.
   (d) An atom of hydrogen has the radius of the order of 10⁻¹⁰ m.
   **Answer:** (c) The size of an atom is expressed in metres.
   The size of an atom is expressed in nanometres.
   \[1 \text{ nm} = 10^{-9} \text{ m}\]

27. Mass of 1 mole of nitrogen atoms is
   (a) 28 g  (b) 14.0 g
   (c) 28 amu  (d) 14 amu
   **Answer:** (b) 14.0 g
   Mass of 1 mole of nitrogen atoms
   \[= \text{Gram atomic mass of nitrogen} \]
   \[= 14 \text{ g}\]

28. Latin name for gold is
   (a) aurum  (b) kalium
   (c) natrium  (d) ferrum
   **Answer:** (a) aurum

29. The atomic mass of sodium is 23. The number of moles in 46 g of sodium are
   (a) 1  (b) 2  (c) 2.3  (d) 4.6
   **Answer:** (b) 2
   \[\text{No. of moles} = \frac{\text{Given mass}}{\text{Molar mass}}\]
   \[= \frac{46}{23} = 2\]

30. All noble gas molecules are
   (a) monatomic  (b) diatomic
   (c) triatomic  (d) both a and b
   **Answer:** (a) monatomic
31. In which of the following the valency of each of the constituent elements is equal to the total number of atoms is one molecule of the compound?
(a) HCl  (b) H₂S  
(c) CaO  (d) MgCl₂

Ans : (c) CaO
In CaO, valency of each of the constituent elements is 2 and is equal to the total number of atoms (2) in one molecule of the compound.

32. Some elements and ions with their valencies are enlisted in the given table:

<table>
<thead>
<tr>
<th>Name (Valency)</th>
<th>Name (Valency)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oxygen (2)</td>
<td>6. Sodium (2)</td>
</tr>
<tr>
<td>2. Iodine (1)</td>
<td>7. Helium (2)</td>
</tr>
<tr>
<td>3. Argon (0)</td>
<td>8. Chlorine (1)</td>
</tr>
<tr>
<td>4. Magnesium (3)</td>
<td>9. Potassium (1)</td>
</tr>
<tr>
<td>5. Carbon (4)</td>
<td>10. Aluminimum (3)</td>
</tr>
</tbody>
</table>

Select the incorrect match.
(a) 4, 5, 7 and 9  (b) 4, 6 and 7  (c) 1, 8, 9 and 10  (d) 2, 3, 5 and 9

Ans : (b) 4, 6 and 7
Magnesium — 2, Sodium — 1, Helium — 0

33. The total number of electrons present in 16 g of methane gas is
(a) 96.352 × 10²³  (b) 48.176 × 10²³  
(c) 60.22 × 10²³  (d) 30.110 × 10²³

Ans : (c) 60.22 × 10²³
Total no. of electrons in 16 g i.e., 1 mole of CH₄
= 10 × 6.022 × 10²³ electrons
= 60.22 × 10²³ electrons

2. FILL IN THE BLANK

1. In ionic compounds, the charge on each ion is used to determine the .......... of the compound.
   Ans : chemical formula

2. Mole is link between the .......... and ..........
   Ans : mass of atoms & number of atoms.

3. The Avogadro constant .......... is defined as the number of atoms in exactly .......... of carbon-12.
   Ans : 6.022 × 10²³, 12 g

4. The valency of an ion is .......... to the charge on the ion.
   Ans : equal.

5. The abbreviation used for lengthy names of elements are termed as their ..........
   Ans : symbol.

6. Those ions which are formed from single atoms are called .......... 
   Ans : simple ions.

7. During a chemical reaction, the sum of the of the reactants and products remains unchanged.
   Ans : masses

8. The SI unit of amount of a substance is .......... 
   Ans : mole

9. Clusters of atoms that act as an ion are called .......... ions.
   Ans : polyatomic

10. Ionic compounds are formed by the combination between .......... and .......... 
   Ans : metal and non-metals.

11. A chemical formula is also known as a .......... 
    Ans : molecular formula.

3. TRUE/FALSE

1. In a pure chemical compound, elements are always present in a definite proportion by mass.
   Ans : True

2. Formula mass of Na₂O is 62 amu.
   Ans : True

3. Mass of 1 mole of a substance is called its formula mass.
   Ans : False

4. Those particles which have more or less electrons than the normal atoms are called ions.
   Ans : True

5. Water is an atom.
   Ans : False

6. Formula for sulphur dioxide is SO₃.
   Ans : False

7. Number of molecules in 32 gram of oxygen is 6.02 × 10²³.
   Ans : True

8. Molar mass of ethyne (C₂H₂) is 26 g/mol.
   Ans : True

9. 22 gm of CO₂ consists of 1 mole.
   Ans : False
4. MATCHING QUESTIONS

DIRECTION: In the section, each question has two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (a), (b), (c) and (d) out of which one is correct.

1. List-I List-II
(P) 52 g of He (1) 2 moles
(Q) 8 g of O₂ (2) 1 mole
(R) 2 g of H₂ (3) 0.25 mole
(S) 56 g of N₂ (4) 13 mole

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>(b)</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>(c)</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>(d)</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Ans: (a) P – 4, Q – 3, R – 2, S – 1

2. List-I List-II
(P) K₂CO₃ (1) 62 u
(Q) Na₂O (2) 138 u
(R) HNO₃ (3) 64 u
(S) SO₂ (4) 63 u

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>(b)</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>(c)</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>(d)</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Ans: (c) P – 2, Q – 1, R – 4, S – 3

3. List-I List-II
(P) 0.25 mole oxygen (1) 6.022 × 10²³ molecules
(Q) 18 g water (2) 1.505 × 10²³ molecules
(R) 46 g Na atom (3) 6.022 × 10²³ atoms
(S) 1 mole C atom (4) 12.044 × 10²³ atoms

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>(b)</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>(c)</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>(d)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Ans: (c) P – 4, Q – 1, R – 2, S – 3

4. List-I List-II
(P) Water (1) 14 : 3
(Q) Ammonia (2) 1 : 8
(R) Carbon-di-oxide (3) 1 : 1
(S) Sulphur-di-oxide (4) 3 : 8

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>(b)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>(c)</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>(d)</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Ans: (d) P – 2, Q – 1, R – 4, S – 3

5. List-I List-II
(P) Calcium (1) 14
(Q) Nitrogen (2) 16
(R) Oxygen (3) 23
(S) Sodium (4) 40

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>(b)</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>(c)</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>(d)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Ans: (c) P – 4, Q – 1, R – 2, S – 3

5. ASSERTION AND REASON

DIRECTION: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

1. **Assertion**: When 10 g of CaCO₃ is decomposed, 5.6 g of residue is left and 4.4 g of CO₂ escapes.
   **Reason**: Law of conservation of mass is followed.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

2. **Assertion**: 1 amu equals to $1.6 \times 10^{-24}$ g.
   **Reason**: $1.66 \times 10^{-24}$ g equals to $\frac{1}{12}$th of mass of a C – 12 atom.
   **Ans**: (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

3. **Assertion**: Pure water obtained from different sources such as river, well, spring, sea etc. always contains hydrogen and oxygen combined in the ratio of 1 : 8 by mass.
   **Reason**: A chemical compound always contains same elements combined in same fixed proportion by mass.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

4. **Assertion**: One atomic mass unit (amu) is mass of an atom equal to exactly one-twelfthth the mass of a carbon-12 atom.
   **Reason**: Carbon-12 isotope was selected as standard.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

5. **Assertion**: Molecular weight of SO₂ is double to that O₂.
   **Reason**: One mole of SO₂ contains double the number of molecules present in one mole of O₂.
   **Ans**: (c) Assertion (A) is true but reason (R) is false. Both, 1 mole of SO₂ and 1 mole of O₂ contain same number of molecules i.e., Avogadro’s number of molecules.

   **Reason**: It states that energy can neither be created nor destroyed in a chemical reaction.
   **Ans**: (d) Assertion (A) is false but reason (R) is true. Law of conservation of mass does not hold good for nuclear reactions due to mass defect. Law of conservation of mass states that matter cannot be created nor destroyed.

7. **Assertion**: 1 mole of H₂ and O₂ each occupy 22.4 L at standard temperature and pressure.
   **Reason**: Molar volume for all gases at the standard temperature and pressure has the same value.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

8. **Assertion**: Atomicity of oxygen is 2.
   **Reason**: 1 mole of an element contains $6.023 \times 10^{23}$ atoms.
   **Ans**: (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

9. **Assertion**: Atomic mass of aluminium is 27.
   **Reason**: An atom of aluminium is 27 times heavier than 1/12th of the mass of carbon-12 atom.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

10. **Assertion**: A molecule is the smallest particle of an element or a compound which is capable of free existence.
    **Reason**: The number of atoms present in one molecule of the substance is called atomicity. e.g., O₂ has two atoms and hence, its atomicity is 2.

11. **Assertion**: Atomicity of O₃ is 3.
    **Reason**: 1 mole of an element contains $6.023 \times 10^{23}$ atoms.
    **Ans**: (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

12. **Assertion**: The molecular mass and formula unit mass of a substance is the sum of atomic masses of all the atoms in the molecular formula or formula unit of a compound.
    **Reason**: The only difference between the molecular mass and formula unit mass is that, former is for molecular compounds (covalent compounds) and latter is for ionic compounds. However, their numerical value is the same.
    **Ans**: (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
13. **Assertion**: Number of gram-molecules of SO\(_2\)Cl\(_2\) in 13.5 g of sulfuryl chloride is 0.1.
   **Reason**: Gram molecular mass is equal to one gram molecule.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
   Gram molecular mass of,
   \[
   \text{SO}_2\text{Cl}_2 = 1 \text{ g molecule}
   \]
   135 g of \(\text{SO}_2\text{Cl}_2 = 1 \text{ g molecule}
   \]
   [Since, GMM of \(\text{SO}_2\text{Cl}_2 = 135 \text{ g}\)]
   13.5 g of \(\text{SO}_2\text{Cl}_2 = \frac{13.5}{135}
   \]
   = 0.1 g molecule

14. **Assertion**: One mole of molecules has mass equal to gram molecular mass and contains Avogadro’s number of molecules or has a volume of 22.4 L at STP if the substance is a gas.
   **Reason**: One mole of an ionic compound has mass equal to gram formula unit mass and contains Avogadro’s number of formula units.
   **Ans**: (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

15. **Assertion**: Percentage of carbon in Na\(_2\)CO\(_3\) is 11.32%.
   **Reason**: 
   \[
   \frac{\text{Mass of carbon element}}{\text{Molecular mass of Na}_2\text{CO}_3} \times 100
   \]
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
   \[
   \frac{12}{106} \times 100 = 11.32\%
   \]

16. **Assertion**: Atomic mass of aluminium is 27.
   **Reason**: An atom of aluminium is 27 times heavier than \(\frac{1}{12}\)th of the mass of carbon-12 atom.
   **Ans**: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).