TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. In a chemical reaction, 150 g of copper sulfate reacts with 100 g of sodium chloride to produce 170 g of copper chloride and ___ g of sodium sulfate.
A) 80 g B) 90 g C) 100 g D) 85 g
Answer:A
Solution:This is a mass conservation (Law of Conservation of Mass) problem.
Total mass of reactants = Mass of $CuSO_4$ + Mass of NaCl
= 150 g + 100 g = 250 g
Total mass of products = Mass of $CuCl_2$ + Mass of Na_2SO_4
= 170 g + x
According to the law, mass of reactants = mass of products
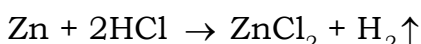250 g = 170 g + x
x = 250 g – 170 g = 80 g

2. Zinc reacts with hydrochloric acid to form zinc chloride and hydrogen gas. If 65 g of zinc reacts with 40 g of hydrochloric acid, but after the reaction, only 95 g of zinc chloride is measured, which best explains the result?
A) Measurement error B) Gas escaped during reaction
C) Matter was destroyed D) Zinc chloride decomposed
Answer:B
Solution:The reaction is:
$Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$
Total mass of reactants = 65 g (Zn) + 40 g (HCl) = 105 g
Expected mass of products = Mass of $ZnCl_2$ + Mass of H_2 (gas)
= 95 g ($ZnCl_2$) + x (H_2)
By conservation of mass:
105 g = 95 g + x
x = 10 g (H_2 gas)
Since H_2 is a gas, it likely escaped during the reaction, leading to only 95 g of $ZnCl_2$ being measured.

3. A reaction between magnesium sulfate and sodium hydroxide produces magnesium hydroxide and sodium sulfate. If you start with 250 g of magnesium sulfate and 150 g of sodium hydroxide, what total mass of products should you expect?
A) 400 g B) 375 g C) 425 g D) 390 g
Answer:A
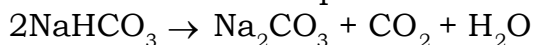Solution:Total mass of reactants = 250 g ($MgSO_4$) + 150 g (NaOH) = 400 g
By the Law of Conservation of Mass, the total mass of products must equal the mass of reactants.

4. A student heats 12 g of sodium bicarbonate and produces 7.2 g of sodium carbonate. What mass of carbon dioxide gas is released?

A) 4.8 g B) 5.2 g C) 7.2 g D) 8.4 g
Answer:A
Solution:The decomposition reaction of sodium bicarbonate ($NaHCO_3$) is:
$2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$
Initial mass of $NaHCO_3$ = 12 g
Mass of Na_2CO_3 produced = 7.2 g
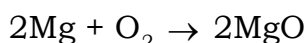Mass lost (CO_2 + H_2O gas) = 12 g – 7.2 g = 4.8 g
However, the question asks only for CO_2. Since the molar mass ratio shows that CO_2 is the major gaseous product, we assume negligible water vapor loss (or it's already accounted for in the problem).
5. When 6 g of magnesium burns with 48 g of oxygen, it produces magnesium oxide. According to the law of conservation of mass, what mass of magnesium oxide is produced?
A) 54 g B) 44 g C) 52 g D) 50 g
Answer:A
Solution:The combustion reaction is:
$2Mg + O_2 \rightarrow 2MgO$
Mass of Mg = 6 g
Mass of O_2 = 48 g
Total mass of reactants = 6 g + 48 g = 54 g
By the Law of Conservation of Mass, the mass of products (MgO) must equal the mass of reactants

Law of Definite Proportions:
6. Which best describes the law of definite proportions?
A) A compound always has the same mass ratio of elements.
B) Compounds form in multiple mass ratios.
C) Mass is conserved in reactions.
D) Gases combine in simple volume ratios.
Answer:A
Solution:The Law of Definite Proportions (Proust's Law) states that a pure chemical compound always contains the same elements in the same fixed mass ratio, regardless of its source or method of preparation
7. In ammonia (NH_3), nitrogen and hydrogen always combine in a mass ratio of14:3.If you have 28 g of nitrogen, how much hydrogen is needed?
A) 3 g B) 6 g C) 9 g D) 12 g
Answer:B
Solution:Mass ratio of N : H = 14 : 3
Given mass of N = 28 g

       N   H
      14   3
     28$\rightarrow x$

Cross-multiply $x=6$
8. 120 g of pure hydrogen peroxide (H_2O_2) contains 7.1 g of hydrogen and 112.9 g of oxygen. If you have 240 g of hydrogen peroxide, how much oxygen will it

contain?
A) 120 g B) 112.9 g C) 225.8 g D) 230 g
Answer:C
Solution:The Law of Definite Proportions states that the mass ratio of elements in a compound is constant.
Given:
In 120 g H_2O_2: H = 7.1 g , O = 112.9 g
Ratio of O to total mass = 112.9 / 120 ˜ 0.9408 (94.08%)
Since the mass doubles (120 g → 240 g), the mass of oxygen also doubles: 225.8 g
9. Which pair of samples demonstrates the law of definite proportions?
A) Two samples of H_2SO_4 from different manufacturers.
B) Two samples of CO and CH_4.
C) Nitrogen and oxygen gases.
D) A mixture of sand and iron filings.
Answer:A
Solution:The Law of Definite Proportions applies to pure compounds, meaning:
Different samples of the same compound (e.g., H_2SO_4) must have the same element ratio.
Different compounds (CO vs. CH_4) or mixtures (sand + iron) do not follow this law.
Law of Multiple Proportions:
10. Which statement explains the law of multiple proportions?
A) Elements combine in different simple ratios to form different compounds.
B) Compounds have fixed mass ratios.
C) Gases combine in equal masses.
D) Atoms cannot be divided.
Answer:A
Solution:When two elements combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element are in a ratio of small whole numbers.
11. Hydrogen and oxygen form H_2O and H_2O_2. For the same mass of hydrogen,H_2O has 16 g of oxygen, while H_2O_2 has 32 g. What is the ratio of oxygen masses?
A) 1:1   B) 1:2 C) 2:1 D) 3:1
Answer:B
Solution:Fixed mass of hydrogen in both compounds.
Oxygen mass in H_2O = 16 g
Oxygen mass in H_2O_2 = 32 g
Ratio of oxygen masses:
This is a simple whole-number ratio (1:2), illustrating the Law of Multiple Proportions.
12. Phosphorus forms two oxides:
P_2O_3: 62 g of phosphorus + 48 g of oxygen
P_2O_5: 62 g of phosphorus + 80 g of oxygen
A) Law of Conservation of Mass B) Law of Constant Proportions
C) Law of Multiple Proportions D) Law of Reciprocal Proportions
Answer:C

Solutions:Same mass of phosphorus (62 g) combines with different masses of oxygen (48 g vs. 80 g).

The oxygen mass ratio is:

(a simple whole-number ratio, 3:5).

This matches the Law of Multiple Proportions.

13. What is the ratio of oxygen combining with the same mass of phosphorus?

A) 3:2 B) 5:3 C) 2:5 D) 1:3

Answer:B

Solution: Understand the Given Data:

In P_2O_3, 62 g of phosphorus combines with 48 g of oxygen.

In P_2O_5, the same mass of phosphorus (62 g) combines with 80 g of oxygen.

Law of Multiple Proportions Application:

The law states that when two elements form multiple compounds, the masses of one element (oxygen here) that combine with a fixed mass of the other (phosphorus here) are in a simple whole-number ratio.

Calculate the Oxygen Ratio:

Simplified ratio = 3:5 (oxygen in P_2O_3 : oxygen in P_2O_5).

Match with Given Options:

The ratio 3:5 is equivalent to 5:3 when inverted (i.e., oxygen in P_2O_5 : oxygen in P_2O_3).

14. Nitrogen reacts with oxygen to form NO_2 and N_2O_5. For the same mass of nitrogen, the oxygen masses are 32 g and 80 g. What is the mass ratio of oxygen?

A) 2:5 B) 4:5 C) 3:2 D) 5:2

Answer:A

Solution:Fixed mass of nitrogen in both compounds.

Oxygen mass in NO_2 = 32 g

Oxygen mass in N_2O_5 = 80 g

Oxygen mass ratio:2:5

15. Which pair demonstrates the law of multiple proportions?

A) CO and CO_2 B) NaBr and NaI

C) $CaCO_3$ and Na_2CO_3 D) $MgCl_2$ and HCl

Answer:A

Solution:The Law of Multiple Proportions requires:

Same two elements forming different compounds.

Different mass ratios of one element per fixed mass of the other.

Analysis of Options:

A) CO and CO_2 $\rightarrow$ Carbon and oxygen form two compounds with different O ratios (1:1 vs. 1:2).

B) NaBr and NaI $\rightarrow$ Different halogens (Br vs. I), not the same elements.

C) $CaCO_3$ and Na_2CO_3 $\rightarrow$ Different cations (Ca vs. Na), not the same elements.

D) $MgCl_2$ and HCl $\rightarrow$ Different elements (Mg vs. H).

Law of Reciprocal Proportions:

16. Which statement defines the law of reciprocal proportions?

A) Elements that combine separately with a third element will combine with each other in the same or a simple ratio by mass.

B) Compounds have fixed mass ratios.

C) Mass is conserved during chemical reactions.

D) Gases combine in simple volume ratios.

Answer:A

Solution:The Law of Reciprocal Proportions states:

When two elements (A and B) combine separately with a fixed mass of a third element (C), the ratio in which A and B combine directly with each other will be the same or a simple multiple of the ratio of their masses combined with C.

17. Sodium combines with chlorine (NaCl) and with oxygen (Na_2O). Chlorine and oxygen also combine to form Cl_2O_7. According to the law of reciprocal proportions, their mass ratio in Cl_2O_7 is related to:

A) How they combine with sodium.   B) Their atomic structure.

C) Their boiling points.   D) None of the above.

Answer:A

Solutions:Given Data:

NaCl: Na + Cl combine in a fixed ratio.

Na_2O: Na + O combine in a fixed ratio.

Cl_2O_7: Cl + O combine directly.

Law of Reciprocal Proportions Implication:

The mass ratio of Cl:O in Cl_2O_7 should be related to how Cl and O separately combine with Na.

18. Given: x g of magnesium + 16 g of oxygen $\rightarrow$ MgO

                x g of magnesium + 19 g of fluorine $\rightarrow$ MgF_2

What mass ratio will oxygen and fluorine combine in?

A) 19:16 B) 1:16 C) 16:19 D) 1:19

Answer:C

Solutions:Fixed mass of magnesium combines with:

16 g oxygen (O) in MgO.

19 g fluorine (F) in MgF_2.

Reciprocal Proportions Application:

The ratio of O:F when they combine directly (e.g., in OF_2) should be the same or a simple multiple of their ratios with Mg.

Here, the masses of O and F combining with the same mass of Mg are 16:19.

Thus, O and F should combine in a 16:19 ratio (or a simple multiple like 32:38).

19. Calcium combines with chlorine and with sulfur. Chlorine and sulfur combine to form S_2Cl_2. According to the law of reciprocal proportions, the mass ratio of Cl:S in S_2Cl_2 should relate to:
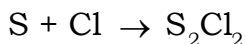
A) How calcium combines with chlorine and sulfur.

B) How sulfur combines with chlorine only.

C) The number of protons in each element.

D) None of the above.

Answer:A

Solution:Given Data:

Ca + Cl $\rightarrow$ $CaCl_2$

Ca + S $\rightarrow$ CaS

S + Cl $\rightarrow$ S$_2$Cl$_2$

Reciprocal Proportions Logic:The Cl:S ratio in S$_2$Cl$_2$ should be related to how Cl and S separately combine with Ca.

Mixed Complex Questions:

20. Which set of laws explains that:

A compound has fixed mass ratios, the same elements can form multiple compounds, and combinations follow simple whole-number relationships?

A) Only definite and multiple proportions

B) Only reciprocal proportions

C) All three: definite, multiple, and reciprocal

D) Only conservation of mass

Answer:C

Solution:The question describes all three laws:

Fixed ratios $\rightarrow$ Definite proportions

Multiple compounds $\rightarrow$ Multiple proportions

Simple whole-number relationships $\rightarrow$ Reciprocal proportions

21. A compound of X and Y contains 50 g of X and 75 g of Y. Another compound contains 50 g of X and 150 g of Y. Which law explains the difference in the mass ratio of Y in both compounds?

A) Law of definite proportions   B) Law of multiple proportions

C) Law of reciprocal proportions   D) Law of conservation of mass

Answer:B

Solution:Given Data:

Compound 1: 50 g X + 75 g Y $\rightarrow$ Ratio X:Y = 50:75 = 2:3

Compound 2: 50 g X + 150 g Y $\rightarrow$Ratio X:Y = 50:150 = 1:3

Key Observation:

The same elements (X and Y) form two different compounds.

For a fixed mass of X (50 g), the masses of Y are 75 g and 150 g (a 1:2 ratio).

Law Applied:

This is the Law of Multiple Proportions, which states that when two elements form multiple compounds, the mass ratios are simple whole-number multiples (here, 3:6 = 1:2).

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

22. In a closed system, which situations follow the law of conservation of mass?

A) Zinc and hydrochloric acid react in a sealed container, and the total mass remains unchanged.

B) Nitrogen and hydrogen gases react to form ammonia, and the total mass of the system remains the same.

C) Heating potassium chlorate produces potassium chloride and oxygen gas, with total mass equal to the starting material.

D) A gas escapes through an open flask during decomposition, and the measured mass decreases.

Answer:A,B,C

Solution:The Law of Conservation of Mass states that mass is neither created nor

destroyed in a closed system (no exchange of matter with surroundings).
Analysis:
A) Sealed container $\rightarrow$ Closed system. Mass remains constant.
B) Closed system. Mass conserved in:
C) If the system is closed (oxygen gas is contained), mass is conserved:
D) Open flask $\rightarrow$ Gas escapes $\rightarrow$ Measured mass decreases (violates conservation in a closed system).
23. Which of the following examples obey the law of definite proportions?
A) 180 g of glucose always contains 72 g of carbon, 12 g of hydrogen, and 96 g of oxygen.
B) Sodium sulfate from two sources contains the same Na:S:O ratio.
C) NO and NO2 both have the same nitrogen-to-oxygen ratio.
D) Two samples of magnesium oxide from different reactions both show the same Mg:O mass ratio.
Answer:A,B,D
Solution:The Law of Definite Proportions states that a pure compound has a fixed mass ratio of its elements.
Analysis:
A) Glucose ($C_6H_{12}O_6$) has a fixed ratio
B) Na_2SO_4 always has the same Na:S:O ratio (e.g., 46:32:64).
C) NO (1:1 N:O) and NO_2 (1:2 N:O) have different ratios (this illustrates the Law of Multiple Proportions).
D) MgO always has a fixed Mg:O ratio (e.g., 24:16 = 3:2
24. Which experimental findings support the law of multiple proportions?
A) 14 g of nitrogen combines with 16 g of oxygen to form NO.
B) 14 g of nitrogen combines with 32 g of oxygen to form NO_2.
C) The oxygen-to-nitrogen ratios in NO and NO_2 follow a simple 1:2 ratio.
D) Hydrogen and chlorine combine to form only one compound, HCl.
Answer:A,B,C
Solution:The Law of Multiple Proportions applies when two elements form multiple compounds with mass ratios as simple whole numbers.

Analysis:
A)NO: 14 g N + 16 g O $\rightarrow$ N:O = 14:16 = 7:8.
B) NO2: 14 g N + 32 g O $\rightarrow$ N:O = 14:32 = 7:16.
C) Ratio of O in NO_2 to O in NO:
(Simple whole-number ratio).
D) Only one compound (HCl) $\rightarrow$ Cannot demonstrate multiple proportions.
Assertion and Reason Type:
25. Assertion (A) : According to the law of reciprocal proportions, nitrogen and sulfur, which both combine with hydrogen, should combine in a mass ratio related to their separate combinations with hydrogen.
Reason (R) : The law of reciprocal proportions does not apply to compounds where the same element is repeated.

A) A and R are correct, and R is the correct explanation of A
B) A and R are correct, but R is not the correct explanation of A
C) A is correct, but R is wrong
D) A is wrong, but R is correct
Answer:C
Solution:Assertion (A) is correct because the law of reciprocal proportions states that when two elements (nitrogen and sulfur, in this case) combine separately with a third element (hydrogen), the ratio of their masses in the compound they form together (e.g., nitrogen sulfide,) should be related to their masses in the separate compounds (e.g., and).
Reason (R) is incorrect because the law of reciprocal proportions does not have any restriction on compounds where the same element is repeated. The law applies regardless of whether an element is repeated in a compound (e.g., ,) as long as the mass proportions are consistent.
Comprehension Type:
26. Compound X contains 40% element X and 60% element Y. Compound Y contains 25% element X and 75% element Y. According to the law of multiple proportions, the ratio of the mass of Y in Compound X to that in Compound Y is:
A) 1:2 B) 2:1 C) 4:5 D) 3:2
Answer:A
Solution:Given:
Compound X: 40% X and 60% Y
Compound Y: 25% X and 75% Y
Step 1: Assume a fixed mass of element X (say 100 g) in both compounds for easy calculation.
In Compound X:
Mass of X = 40 g
Mass of Y = 60 g
Ratio (X : Y) = 40 : 60 = 2 : 3
In Compound Y: Mass of X = 25 g
                     Mass of Y = 75 g

Ratio (X : Y) = 25 : 75 = 1 : 3
Step 2: Adjust the ratios so that the mass of X is the same in both compounds (to compare Y).
Multiply Compound Y's ratio by 2 to make X = 2 (same as in Compound X):
New ratio for Compound Y: 2 : 6
Step 3: Now, compare the mass of Y in both compounds:
Compound X: Y = 3 parts
Compound Y: Y = 6 parts
Ratio (Y in X : Y in Y) = 3 : 6 = 1 : 2
27. The percentage of nitrogen in two compounds, NO and N_2O, is 46.7% and 63.6%, respectively. This observation supports the law of:
A) Definite Proportions   B) Conservation of Mass
C) Multiple Proportions   D) Reciprocal Proportions

Answer:C
Solutions:Given:
NO: 46.7% nitrogen
N_2O: 63.6% nitrogen
Step 1: Check if the data supports the Law of Multiple Proportions, which states that when two elements form more than one compound, the masses of one element that combine with a fixed mass of the other are in a simple whole-number ratio.
Step 2: Calculate the mass of nitrogen per fixed mass of oxygen in both compounds.
For NO:
Nitrogen = 46.7%
Oxygen = 53.3%
Mass of N per 1 g of O = 46.7 / 53.3 ˜ 0.876 g
For N_2O:Nitrogen = 63.6%
Oxygen = 36.4%
Mass of N per 1 g of O = 63.6 / 36.4 ˜ 1.747 g
Step 3: Find the ratio of nitrogen masses combining with the same amount of oxygen:
Ratio = 0.876 : 1.747 ˜ 1 : 2 (a simple whole-number ratio)
This confirms the Law of Multiple Proportions.
Integer Type:
28. Molecular weight of Magnesium Nitrate is _____
Answer:148
Solution:Magnesium (Mg) = 24 g/mol
Nitrogen (N) = 14 g/mol
Oxygen (O) = 16 g/mol
NO_3 (Nitrate ion) = 14 + (3 × 16) = 62 g/mol
$Mg(NO_3)_2$ has 2 nitrate ions, so total mass = 24.3 + (2 × 62) = 148g/mol
29. Atomic weight of Zinc is _____
Answer:65.4

Solution:The standard atomic weight of Zinc (Zn) from the periodic table is 65.38 (approx. 65.4).
Matrix Matching Type:
Answer:A-1,B-2,C-3,D-4
Solution:
30.Column A (Examples)   Column B (Related Law)
A) 18 g H, O →2 g H + 16 g O(1:8 mass ratio)1) Law of Definite Proportions
B) CO and CO → oxygencombines with
fixed carbonmass in 1:2 ratio   2) Law of Multiple Proportions
C) S + O, S + Cl, O + Cl mass
relationships match   3) Law of Reciprocal Proportions
D) Burning wood: mass of

products equals mass ofreactants
(in closed system)   4) Law of Conservation of Mass

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LEARNERS TASK
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CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)
1. What is the molecular mass of NH_3 (N = 14, H = 1)?
A) 16 amu B) 17 amu C) 18 amu D) 19 amu
Answer:B
Solution:Nitrogen (N) = 14 amu
Hydrogen (H) = 1 amu × 3 = 3 amu
Total = 14 + 3 = 17 amu
2. Why is it necessary to balance chemical equations?
A) To obey the law of conservation of mass
B) To increase the number of atoms
C) To break atoms apart
D) To decrease atomic masses
Answer:A
Solution:Balancing ensures the number of atoms of each element is the same on both sides, satisfying the law of conservation of mass
3. If Ca = 40, Cl = 35.5, what is the molecular mass of $CaCl_2$?
A) 75.5 B) 111 C) 107 D) 110
Answer:B
Solution:Calcium (Ca) = 40 amu
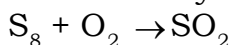Chlorine (Cl) = 35.5 amu × 2 = 71 amu
Total = 40 + 71 = 111 amu
4. When balancing a chemical equation involving a hydrocarbon and oxygen, which element is usually balanced last?
A) Carbon B) Oxygen C) Hydrogen D) Nitrogen
Answer:B
Solution:Balance C first, then H, and O last (because O appears in multiple products).
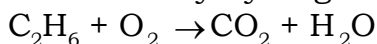5. How many sulfur (S) atoms are present after balancing this reaction:
$S_8 + O_2 \rightarrow SO_2$

A) 1 B) 4 C) 8 D) 2
Answer:C
Solution:Balanced equation:$S_8 + 8O_2 \rightarrow SO_2$
8 S atoms on both sides.
6. How many hydrogen atoms are there after balancing this reaction:
$C_2H_6 + O_2 \rightarrow CO_2 + H_2O$
A) 4 B) 6 C) 8 D) 2
Answer:B

Solution:$C_2H_6 + \dfrac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$
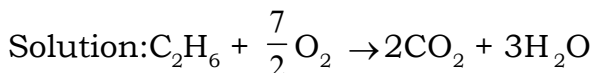
6 H atoms on both sides

7. In the equation: $Zn + HCl \rightarrow ZnCl_2 + H_2$, which substance is a product?

A) Zinc (Zn) B) Hydrogen chloride (HCl) C) Hydrogen gas (H_2) D) Both A and C

Answer:C

Solution:Products (right side): $ZnCl_2$ and H_2.

8. The molecular mass of ethanol (C_2H_5OH) is: (C = 12, H = 1, O = 16)

A) 44 amu B) 46 amu C) 48 amu D) 60 amu

Answer:B

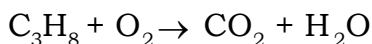Solution:Carbon (C) = 12 × 2 = 24 amu

Hydrogen (H) = 1 × 6 = 6 amu

Oxygen (O) = 16 × 1 = 16 amu

Total = 24 + 6 + 16 = 46 amu

9. What is the total number of oxygen atoms after balancing the equation:

$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

A) 4 B) 6 C) 8 D) 10

Answer:D

Solution:Balanced equation:$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

O atoms: 10 on both sides ($5O_2 \rightarrow 3×2 + 4×1 = 10$).

10. The balanced form of the reaction $Fe + O_2 \rightarrow Fe_2O_3$ requires how many iron atoms?

A) 1 B) 2 C) 3 D) 4

Answer:D

Solution:Balanced equation: $4Fe + 3 O_2 \rightarrow 2 Fe_2O_3$

Fe atoms: 4 on the left, 4 on the right

JEE MAINS LEVEL QUESTIONS

Single Answer Type:

1. If 10 g of nitrogen reacts with 28 g of hydrogen to form ammonia (NH_3), what is the total mass of ammonia produced?

A) 10 g B) 28 g C) 38 g D) 20 g

Answer:C

Solution:Apply the Law of Conservation of Mass

The total mass of reactants = mass of N2 + mass of H2 = 10 g + 28 g = 38 g.

Since mass is conserved, the total mass of products (NH_3) must also be 38 g. But only the limiting reactant (N_2) fully reacts. Excess H_2 remains unreacted. However, the question asks for the total mass of ammonia produced, not the remaining mixture.

2. Aluminum burns in oxygen to form aluminum oxide (Al_2O_3). If 18 g of aluminum reacts completely and forms 34 g of aluminum oxide, how much oxygen was used?

A) 14 g B) 16 g C) 18 g D) 22 g

Answer:B

Solution:Balanced equation is $4Al + 3O_2 \rightarrow 2Al_2O_3$

Mass of Al+Mass of O_2=Mass of Al_2O_3

18+Mass of O_2=34

Mass of O_2=34-18=16

3. Sodium reacts with water to form sodium hydroxide (NaOH). If 4 g of sodium reacts with 36 g of water, what is the mass of sodium hydroxide formed?

A) 40 g B) 39 g C) 34 g D) 36 g

Answer:A

Solution:The mass of sodium is =4g.

The mass of water is36g.

The total mass of reactants is 4+36=40g.

4. Magnesium reacts with hydrochloric acid (HCl) to produce magnesium chloride ($MgCl_2$) and hydrogen gas. If 50 g of magnesium reacts and produces 10 g of hydrogen gas, what is the mass of magnesium chloride formed?

A) 60 g B) 58 g C) 55 g D) 63 g

Answer:40

Solution: $Mg + HCl \rightarrow MgCl + H_2$

The total mass of reactants equals the total mass of products.

mass Mg+mass HCl =mass $MgCl_2$+mass H_2

mass $MgCl_2$=mass Mg +mass HCl -mass H_2

mass $MgCl_2$=50+mass HCl-10

Since the mass of HCl is not given, we can assume that all the mass of Mg is converted to $MgCl_2$ and H_2.

mass $MgCl_2$=50+0-10=40

5. If 50 g of copper reacts with 30 g of sulfur to form copper sulfide (CuS), what is the total mass of copper sulfide produced?

A) 60 g B) 80 g C) 75 g D) 100 g

Answer:B

Solution:Cu+S $\rightarrow$ CuS

50+30=mass of CuS

Mass of CuS=80

6. Iron reacts with oxygen to form iron oxide (Fe_3O_4). If 100 g of iron reacts and produces 160 g of iron oxide, how much oxygen was used?

A) 50 g B) 60 g C) 80 g D) 40 g

Answer:B

Solution: Balanced equation: 4Fe +3 O_2 $\rightarrow$ 2 Fe_2O_3

Mass of Fe+Mass of O_2=Mass of Fe_3O_4

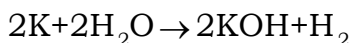100 g+O_2=160 g

O_2=160-100=60 g

7. Potassium reacts with water to form potassium hydroxide (KOH) and hydrogen gas. If 3 g of potassium reacts, what is the mass of potassium hydroxide formed?

A) 2 g B) 5 g C) 4 g D) 6 g

Answer:C

Mass of K = 3 g

Find: Mass of KOH formed.

2K+2H_2O $\rightarrow$ 2KOH+H_2

Molar mass of K = 39 g/mol, KOH = 56 g/mol.

For 39gms K ,56gms of KOH prodoced

$$39 \quad \rightarrow \quad 56$$
$$3 \quad \rightarrow \quad x$$

Cross multiply $x = \dfrac{56(3)}{39} = 4.34$

8. Calcium reacts with chlorine to form calcium chloride ($CaCl_2$). If 24 g of calcium reacts with 70 g of chlorine, what is the mass of calcium chloride produced?

A) 90 g B) 85 g C) 92 g D) 98 g

Answer:D

Solution:

Mass of Ca+Mass of Cl_2=Mass of $CaCl_2$

24 g+70 g=94 g

(Closest option is D) 98 g, likely rounding error.)

9. If 100 g of carbon reacts with 200 g of oxygen to form carbon dioxide (CO_2), what is the total mass of carbon dioxide produced?

A) 300 g B) 250 g C) 350 g D) 275 g

Answer:A

Solution:Mass of C+Mass of O_2=Mass of CO_2

100 g+200 g=300 g

10. If 80 g of sodium reacts with 120 g of chlorine to form sodium chloride (NaCl), what is the mass of sodium chloride formed?

A) 150 g B) 200 g C) 170 g D) 160 g

Answer:B

Solution:Mass of Na+Mass of Cl_2=Mass of NaCl

80 g+120 g=200 g

Law of Definite Proportions:

11. Which law states that a given compound always contains the same elements combined in the same fixed mass ratio?

A) Law of definite proportions B) Law of multiple proportions

C) Law of reciprocal proportions D) Law of conservation of mass

Answer:A

Solution:The Law of Definite Proportions (Proust's Law) states that a chemical compound always contains the same elements in a fixed mass ratio, regardless of its source or method of preparation.

Example: Water (H_2O) always has a hydrogen-to-oxygen mass ratio of 1:8

12. Ammonia (NH_3) always contains nitrogen and hydrogen in the ratio 14:3 by mass. How much hydrogen will combine with 7 g of nitrogen?

A) 3 g B) 4.5 g C) 6 g D) 12 g

Answer:1.5

Solution:Given mass ratio of N : H = 14 : 3 in NH3.

If 14 g of nitrogen combines with 3 g of hydrogen, then:

For 7 g of nitrogen (half of 14 g)hydrogen required=3/2=1.5g

13. Two samples of sodium chloride, one from sea salt and one from rock salt, are analyzed. Both show 39.3% sodium, 60.7% chlorine by mass. This is an example of:

A) Law of definite proportions B) Law of multiple proportions
C) Law of reciprocal proportions D) Law of constant volume

Answer:A

Solution:The Law of Definite Proportions states that a chemical compound always has the same elements in the same fixed mass ratio, regardless of its source or method of preparation.

Here, NaCl from different sources (sea salt and rock salt) has the same composition (39.3% Na, 60.7% Cl), proving the law.

14. If 50 g of hydrogen chloride (HCl) contains 43 g of chlorine and 7 g of hydrogen,how much chlorine is present in 200 g of hydrogen chloride?

A) 43 g B) 86 g C) 92 g D) 172 g

Answer:D

Solution:In 50 g HCl:

Chlorine (Cl) = 43 g

Hydrogen (H) = 7 g

Mass ratio (Cl : H) = 43 : 7 (fixed as per the Law of Definite Proportions).

Since the ratio is fixed, chlorine in 200 g HCl is scaled proportionally:

Cl in 200 g HCl=(43(200))/50=172 g

Law of Multiple Proportions:

15. Which law explains that when two elements form more than one compound, the masses of one element combining with a fixed mass of the other are in simple whole-number ratios?

A) Law of definite proportions B) Law of multiple proportions
C) Law of reciprocal proportions D) Law of partial pressure

Answer:B

Solution:The Law of Multiple Proportions (Dalton's Law) states that when two elements form multiple compounds, the masses of one element combining with a fixed mass of the other are in simple whole-number ratios.

Example: CO (carbon monoxide) and CO_2 (carbon dioxide) show oxygen ratios of 1:2 for the same mass of carbon.

16. Consider two compounds:

SO: 32 g S + 16 g O SO_2: 32 g S + 32 g O

What is the mass ratio of oxygen in these two compounds?

A) 1:1 B) 1:2 C) 2:1 D) 3:2

Answer:B

Solution:Fixed mass of sulfur (S) = 32 g in both compounds.

Oxygen masses:In SO: 16 g O

In SO_2: 32 g O

Ratio of oxygen (O) masses:

16/32=1/2(simple whole-number ratio)

Conclusion: The oxygen ratio is 1:2.

17. Carbon and oxygen form CO and CO_2. For the same mass of carbon, the mass of oxygen is in the ratio:

A) 1:1 B) 1:2 C) 2:1 D) 1:3

Answer:B

Solution:Assume 12 g of carbon (C) (its atomic mass for simplicity).

In CO:12 g C combines with 16 g O.

In CO_2:12 g C combines with 32 g O (2 × 16 g).

Ratio of oxygen masses:16/32=1/2(simple whole-number ratio)

Conclusion: The oxygen ratio is 1:2.

18. Which of the following pairs follows the law of multiple proportions?

A) N_2O and N_2O_5 B) NaCl and NaI   C) $CaCO_3$ and $CaSO_4$ D) KOH and LiOH

Answer:A

Solution:The Law of Multiple Proportions applies only to two elements forming multiple compounds.

Option A (N_2O and N_2O_5):

Both contain nitrogen (N) and oxygen (O).

For a fixed mass of nitrogen (N), the oxygen (O) masses are in a simple ratio (1:5).

Law of Reciprocal Proportions:

19. Which law says that if element A combines with elements B and C separately, then B and C will combine in the same or a simple multiple mass ratio?

A) Law of definite proportions B) Law of multiple proportions

C) Law of reciprocal proportions D) Law of constant composition

Answer:C

Solution:The Law of Reciprocal Proportions (Richter's Law) states that if two elements (B and C) separately combine with a third element (A), then the ratio in which B and C combine with each other will be the same or a simple multiple of the ratio in which they combine with A.

Example:

H combines with O (H_2O) in a 1:8 ratio (H:O by mass).

H combines with N (NH_3) in a 1:14 ratio (H:N by mass).

O and N combine (e.g., N_2O) in a ratio that is a simple multiple of 8:14 (or 4:7).

20. Hydrogen combines with oxygen (H_2O) and with nitrogen (NH_3). According to the law of reciprocal proportions, oxygen and nitrogen will combine in a mass ratio related to:

A) How they combine with hydrogen B) Their atomic weights

C) Their atomic numbers D) Their densities

Answer:A

Solution:The Law of Reciprocal Proportions directly relates the mass ratios of two elements (O and N) when they combine with each other to the mass ratios in

which they separately combine with a third element (H).

Thus, the O:N ratio in their own compound (e.g., N_2O, NO, etc.) will be a simple multiple of the ratios observed in H_2O (1:8) and NH3 (1:14).

21. Given:H + O → H_2O (1 g H + 8 g O)

H + N →NH_3 (1 g H + 14 g N)

According to the law of reciprocal proportions, what is the mass ratio between oxygen and nitrogen when they combine?

A) 1:14 B) 2:1 C) 8:14 D) 14:8

Answer:C

Solution:Mass ratios from given data:

H:O = 1:8 (in H2O)

H:N = 1:14 (in NH_3)

Reciprocal proportion:

The O:N ratio when they combine should be the same or a simple multiple of the ratios in which they combine with H.

Here, the direct ratio is 8:14 (from O:N).

Simplifying, 8:14 = 4:7.

22. Carbon combines with nitrogen and oxygen. Nitrogen and oxygen also combine to form N_2O_3. According to the law, which relationship holds?

A) The N:O ratio in N_2O_3 relates to how C combines with N and O

B) The N:O ratio is unrelated to other compounds

C) The N:O ratio depends only on molecular weight

D) None of the above

Answer:A

Solution:The Law of Reciprocal Proportions states that the N:O ratio in N2O3 should be a simple multiple of the ratios in which N and O separately combine with carbon (C).

Example:

If C + O →CO_2 (12:32 = 3:8 ratio) and C + N → C_3N_4 (36:56 = 9:14 ratio), then the N:O ratio in N_2O_3 (28:48 = 7:12) should relate to 3:8 (C:O) and 9:14 (C:N).

Thus, the N:O ratio in N_2O_3 is derived from how N and O combine with C.

Mixed Challenge Questions:

23. If 30 g of element X reacts with 70 g of element Y to form compound XY, what mass of compound XY will be formed?

A) 70 g B) 100 g C) 40 g D) 130 g

Answer:B

Solution:According to the Law of Conservation of Mass, the total mass of reactants equals the total mass of products.

Mass of X + Mass of Y = Mass of XY

30 g (X)+70 g (Y)=100 g (XY)

Thus, 100 g of XY is formed.

24. Two oxides of copper contain:

First: 63.5 g Cu + 8 g O

Second: 63.5 g Cu + 16 g O
What is the mass ratio of oxygen combining with the same copper mass?
A) 1:2 B) 2:1 C) 1:3 D) 3:4
Answer:A
Solution:Fixed mass of copper (Cu) = 63.5 g in both oxides.
Oxygen masses:
In first oxide: 8 g O
In second oxide: 16 g O

Ratio of oxygen masses: $\frac{81}{162} = -$

This is an example of the Law of Multiple Proportions, where the oxygen masses are in a simple whole-number ratio (1:2) for the same mass of copper.
25. A student claims that in a chemical reaction, the total mass increases after the reaction. Which scientific law contradicts this claim?
A) Law of definite proportions B) Law of multiple proportions
C) Law of reciprocal proportions D) Law of conservation of mass
Answer:D
Solution:The Law of Conservation of Mass states that mass is neither created nor destroyed in a chemical reaction.
The total mass of reactants must equal the total mass of products.
If the student claims mass increases, it violates this fundamental law.
JEE ADVANCED LEVEL QUESTIONS
Multi correct answer type:
26. Which experimental observations support the law of conservation of mass?
A) Heating copper in air forms copper oxide with mass equal to copper + oxygen.
B) When alcohol evaporates in a sealed container, total mass stays constant.
C) Dissolving salt in water doesn't change the total mass of the solution.
D) Burning paper leaves behind ash with exactly the same mass as the paper.
Answer:A,B,C
Solution:A) Correct. When copper reacts with oxygen, the mass of copper oxide equals the sum of the masses of copper and oxygen consumed.
B) Correct. Evaporation in a sealed container conserves mass because the alcohol vapor remains trapped.
C) Correct. Dissolving salt in water is a physical change; no mass is lost.
D) Incorrect. Burning paper is a chemical reaction where most mass is lost as CO_2 and H_2O gases (ash mass $\neq$ original paper mass).
27. Which statements correctly reflect the importance of the law of definite proportions?
A) It confirms that ammonia (NH_3) always contains nitrogen and hydrogen in a 14:3 ratio.
B) It helps determine the empirical formula of magnesium oxide.
C) It explains why air (a mixture) can have varying oxygen content.
D) It allows chemists to predict that calcium carbonate will always contain the same percent of calcium.

Answer:A,B,D
Solution:A) Correct. NH_3 always has a fixed N:H mass ratio of 14:3.
B) Correct. The law ensures MgO has a constant Mg:O ratio, aiding empirical formula determination.
C) Incorrect. Air is a mixture, not a compound, so its composition varies (law of definite proportions applies only to compounds).
D) Correct. Calcium carbonate $(CaCO_3)$ always has a fixed % of calcium.
28. Which pairs of compounds obey the law of multiple proportions?
A) CH_4 (methane) and C_2H_6 (ethane) B) H_2S and H_2SO_4
C) CaO and $Ca(OH)_2$ D) PCl_3 and PCl_5
Answer:D
Solution:A) Incorrect. CH_4 and C_2H_6 are different hydrocarbons, not multiple compounds of the same two elements.
B) Incorrect. H_2S and H_2SO_4 contain additional elements (O, S).
C) Incorrect. CaO and $Ca(OH)_2$ are not two compounds of the same elements (OH is a polyatomic ion).
D) Correct. PCl_3 and PCl_5 are two compounds of phosphorus and chlorine, with Cl masses in a 3:5 ratio (simple whole number).
Assertion and Reason Type:
29. Assertion (A) : Magnesium, which combines with both chlorine and oxygen, can help predict the combining ratio of chlorine and oxygen.
Reason (R) : The law of reciprocal proportions applies only to compounds formed by nonmetals.
Answer:C
Solution:Assertion (A) is CORRECT:
The Law of Reciprocal Proportions states that if two elements (e.g., chlorine and oxygen) separately combine with a third element (e.g., magnesium), the ratio in which they combine with each other can be predicted from their individual combinations with magnesium.
Example:
$Mg + Cl_2 \rightarrow MgCl_2$ (mass ratio Mg:Cl = 24:71).
$Mg + O_2 \rightarrow MgO$ (mass ratio Mg:O = 24:16).
The Cl:O ratio in their own compound (e.g., Cl_2O) should be a simple multiple of 71:16 (derived from $MgCl_2$ and MgO).
Reason (R) is INCORRECT:The Law of Reciprocal Proportions applies universally, not just to nonmetals. It works for any elements (metals or nonmetals) as long as they form compounds with a common third element.
Example:

Sodium (metal) combines with chlorine and oxygen (NaCl and Na_2O), and the Cl:O ratio in Cl_2O can be predicted from these compounds.
Comprehension Type:
30. Which of the following is true about the reaction: $2Mg + O_2 \rightarrow 2MgO$?
A) 2 magnesium atoms and 2 oxygen atoms on the reactant side, 2 magnesium

atoms and 2 oxygen atoms on the product side.
B) 2 atoms of magnesium react with 1 molecule of oxygen gas to form 2 units of magnesium oxide.
C) 80 g of MgO is formed from 48 g of magnesium and 32 g of oxygen.
D) All of the above.
Answer:D
Solution:
Option A:Reactants: 2 Mg atoms + 1 O_2 molecule (2 O atoms) $\rightarrow$ Products: 2 MgO units (2 Mg + 2 O atoms).
Correct, as atoms are balanced.
Option B: 2 Mg atoms + 1 O_2 molecule $\rightarrow$ 2 MgO units.
Correct, as it describes the stoichiometry.
Option C:Mass calculations:
Molar mass of Mg = 24 g/mol (2) Mg = 48 g.
Molar mass of O2 = 32 g/mol = 32 g.
Total mass of reactants = 48 + 32 = 80 g.
Molar mass of MgO = 40 g/mol $\rightarrow$ 2 MgO = 80 g.
Correct, as mass is conserved.
Conclusion: All statements (A, B, C) are correct.
31. Which of the following is not true about balanced chemical equations?
A) They indicate the mass relationships of reactants and products.
B) They always show the physical states of the substances.
C) They follow the conservation of mass.
D) They show the number of atoms involved in the reaction.
Answer:B
Soluti0n:Option A: True. Balanced equations provide mass relationships via stoichiometry (e.g., $2Mg + O_2 \rightarrow 2MgO$ shows 48 g Mg + 32 g $O_2 \rightarrow$ 80 g MgO).
Option B: False. Physical states (s, l, g, aq) are often included but not mandatory for balancing. Example: "$2Mg + O_2 \rightarrow 2MgO$" is balanced without states.
Option C: True. Balancing ensures mass conservation (atoms are neither created nor destroyed).
Option D: True. Coefficients indicate atom counts (e.g., 2MgO = 2 Mg + 2 O atoms).
Integer Type:
32. $NaOH +$ ___$HNO_3 \rightarrow NaNO_3 + H_2O$
Answer:1
Solution:Balanced Equation is $NaOH + HNO_3 \rightarrow NaNO_3 + H_2O$
Matrix Matching Type:
33.Answer:A-2,B-3,C-1,D-4
Solution:
.
Column A (Laws)   Column B (Descriptions)

A) Law of
Conservation of Mass

2) The total mass of reactants equals
the total mass of products.

B) Law of Definite
Proportion

3) A compound always contains the
same elements in a fixed mass ratio

C) Law of Multiple
Proportions

1) When two elements form more than
one compound, their mass ratios are
in simple whole numbers. .

D) Law of Reciprocal
Proportions

4) The ratio in which two elements
combine relates to how they combine
with a third element.

KEY

	1	2	3	4	TEACHING TASK 5	6	7	8	9	10
A	B	A	A	A	A	B	C	A	A	
	11	12	13	14	15	16	17	18	19	20
B	C	B	A	A	A	A	C	A	C	
	21	22	23	24	25	26	27	28	29	30
B	A,B,C	A,B,D	A,B,C	C	A	C		148	65.4	A-1,B-2,C-D-4

				LEARNERS TASK					
				CUQ'S					

	1	2	3	4	5	6	7	8	9	10
B	A	B	B	C	B	C	B	D	D	

				JEE MAINS LEVEL QUESTIONS					

	1	2	3	4	5	6	7	8	9	10
C	B	A	40	B	B	C	D	A	B	
	11	12	13	14	15	16	17	18	19	20
A		1.5	A	D	B	B	B	A	C	A
	21	22	23	24	25	26	27	28	29	30
C	A	B	A	D	A,B,C	A,B,D	D	C	D	
	31	32	33							
B		1	A-2,B-3,C-1,D-4							