

1.3 Properties of Matter and their Measurement

1.4 Uncertainty in Measurement

2. Given the numbers : 161 cm, 0.161 cm, 0.0161 cm. The number of significant figures for the three numbers is

- (a) 3, 3 and 4 respectively
- (b) 3, 4 and 4 respectively
- (c) 3, 4 and 5 respectively
- (d) 3, 3 and 3 respectively.

(1998)

1.5

Laws of Chemical Combinations

3. Equal masses of H_2 , O_2 and methane have been taken in a container of volume V at temperature 27°C in identical conditions. The ratio of the volumes of gases H_2 : O_2 : CH_4 would be
(c) $16 : 1 : 2$ (d) $8 : 1 : 2$ (2014)

4. What volume of oxygen gas (O_2) measured at 0°C and 1 atm, is needed to burn completely 1 L of propane gas (C_3H_8) measured under the same conditions?
(a) 5 L (b) 10 L
(c) 7 L (d) 6 L (2008)

5. 0.24 g of a volatile gas, upon vaporisation, gives 45 mL vapour at NTP. What will be the vapour density of the substance? (Density of $\text{H}_2 = 0.089 \text{ g/L}$)
(a) 95.93 (b) 59.93
(c) 95.39 (d) 5.993 (1996)

6. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. At 15°C and 150 mmHg pressure, one litre of O_2 contains 'N' molecules. The number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be

7. What is the weight of oxygen required for the complete combustion of 2.8 kg of ethylene?

(a) $N/2$ (b) N
(c) $2N$ (d) $4N$ (1990)

(a) 2.8 kg (b) 6.4 kg
(c) 9.6 kg (d) 96 kg (1989)

1.7 Atomic and Molecular Masses

1.8 Mole Concept and Molar Masses

10. Which one of the followings has maximum number of atoms?

- (a) 1 g of $\text{Ag}_{(s)}$ [Atomic mass of Ag = 108]
- (b) 1 g of $\text{Mg}_{(s)}$ [Atomic mass of Mg = 24]
- (c) 1 g of $\text{O}_{2(g)}$ [Atomic mass of O = 16]
- (d) 1 g of $\text{Li}_{(s)}$ [Atomic mass of Li = 7]

(NEET 2020)

11. In which case is number of molecules of water maximum?

- 18 mL of water
- 0.18 g of water
- 0.00224 L of water vapours at 1 atm and 273 K
- 10^{-3} mol of water (NEET 2018)

12. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2 . When 0.1 mole of XY_2 weighs 10 g and 0.05 mole of X_3Y_2 weighs 9 g, the atomic weights of X and Y are

(a) 40, 30 (b) 60, 40
(c) 20, 30 (d) 30, 20 (NEET-II 2016)

13. If Avogadro number N_A is changed from $6.022 \times 10^{23} \text{ mol}^{-1}$ to $6.022 \times 10^{20} \text{ mol}^{-1}$, this would change
(a) the mass of one mole of carbon
(b) the ratio of chemical species to each other in a balanced equation
(c) the ratio of elements to each other in a compound
(d) the definition of mass in units of grams. (2015)

14. The number of water molecules is maximum in
(a) 1.8 gram of water
(b) 18 gram of water
(c) 18 moles of water
(d) 18 molecules of water. (2015)

15. A mixture of gases contains H_2 and O_2 gases in the ratio of 1 : 4 (w/w). What is the molar ratio of the two gases in the mixture?
(a) 16 : 1 (b) 2 : 1
(c) 1 : 4 (d) 4 : 1 (2015, Cancelled)

16. Which has the maximum number of molecules among the following?
(a) 44 g CO_2 (b) 48 g O_3
(c) 8 g H_2 (d) 64 g SO_2
(Mains 2011)

17. The number of atoms in 0.1 mol of a triatomic gas is ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$)
(a) 6.026×10^{22} (b) 1.806×10^{23}
(c) 3.600×10^{23} (d) 1.800×10^{22} (2010)

18. The maximum number of molecules is present in
(a) 15 L of H_2 gas at STP
(b) 5 L of N_2 gas at STP
(c) 0.5 g of H_2 gas
(d) 10 g of O_2 gas. (2004)

19. Which has maximum molecules?
(a) 7 g N_2 (b) 2 g H_2
(c) 16 g NO_2 (d) 16 g O_2 (2002)

20. Specific volume of cylindrical virus particle is $6.02 \times 10^{-2} \text{ cc/g}$ whose radius and length are 7 Å and 10 Å respectively. If $N_A = 6.02 \times 10^{23}$, find molecular weight of virus.
(a) 15.4 kg/mol (b) $1.54 \times 10^4 \text{ kg/mol}$
(c) $3.08 \times 10^4 \text{ kg/mol}$ (d) $3.08 \times 10^3 \text{ kg/mol}$
(2001)

21. The number of atoms in 4.25 g of NH_3 is approximately
(a) 4×10^{23} (b) 2×10^{23}
(c) 1×10^{23} (d) 6×10^{23} (1999)

22. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atoms (Atomic weight of Fe is 56) present in one molecule of haemoglobin is
(a) 4 (b) 6
(c) 3 (d) 2 (1998)

23. The number of moles of oxygen in one litre of air containing 21% oxygen by volume, under standard conditions, is
(a) 0.0093 mol (b) 2.10 mol
(c) 0.186 mol (d) 0.21 mol (1995)

24. The total number of valence electrons in 4.2 g of N_3^- ion is (N_A is the Avogadro's number)
(a) $2.1 N_A$ (b) $4.2 N_A$
(c) $1.6 N_A$ (d) $3.2 N_A$ (1994)

25. The number of gram molecules of oxygen in 6.02×10^{24} CO molecules is
(a) 10 g molecules (b) 5 g molecules
(c) 1 g molecule (d) 0.5 g molecules.
(1990)

26. Ratio of C_p and C_v of a gas 'X' is 1.4. The number of atoms of the gas 'X' present in 11.2 litres of it at NTP will be
(a) 6.02×10^{23} (b) 1.2×10^{23}
(c) 3.01×10^{23} (d) 2.01×10^{23} (1989)

27. The number of oxygen atoms in 4.4 g of CO_2 is
(a) 1.2×10^{23} (b) 6×10^{22}
(c) 6×10^{23} (d) 12×10^{23} (1989)

28. 1 cc N_2O at NTP contains
(a) $\frac{1.8}{224} \times 10^{22}$ atoms
(b) $\frac{6.02}{22400} \times 10^{23}$ molecules
(c) $\frac{1.32}{224} \times 10^{23}$ electrons
(d) all of the above. (1988)

29. An organic compound contains carbon, hydrogen and oxygen. Its elemental analysis gave C, 38.71% and H, 9.67%. The empirical formula of the compound would be
(a) CHO (b) CH_4O
(c) CH_3O (d) CH_2O (2008)

30. Percentage of Se in peroxidase anhydrous enzyme is 0.5% by weight (at. wt. = 78.4) then minimum molecular weight of peroxidase anhydrous enzyme is
(a) 1.568×10^4 (b) 1.568×10^3
(c) 15.68 (d) 2.136×10^4 (2001)

1.9 Percentage Composition

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31. Which of the following fertilizers has the highest nitrogen percentage?

- (a) Ammonium sulphate
- (b) Calcium cyanamide
- (c) Urea
- (d) Ammonium nitrate (1993)

1.10 Stoichiometry and Stoichiometric Calculations

36. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0 g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample?
(At. wt. of Mg = 24)

(a) 96 (b) 60
 (c) 84 (d) 75 (2015)

37. When 22.4 litres of $\text{H}_2(g)$ is mixed with 11.2 litres of $\text{Cl}_2(g)$, each at STP, the moles of $\text{HCl}(g)$ formed is equal to
 (a) 1 mol of $\text{HCl}(g)$ (b) 2 mol of $\text{HCl}(g)$
 (c) 0.5 mol of $\text{HCl}(g)$ (d) 1.5 mol of $\text{HCl}(g)$ (2014)

38. 1.0 g of magnesium is burnt with 0.56 g O₂ in a closed vessel. Which reactant is left in excess and how much? (At. wt. Mg = 24, O = 16)

41. 25.3 g of sodium carbonate, Na_2CO_3 is dissolved in enough water to make 250 mL of solution. If sodium carbonate dissociates completely, molar concentration of sodium ion, Na^+ and carbonate ions, CO_3^{2-} are respectively

(Molar mass of $\text{Na}_2\text{CO}_3 = 106 \text{ g mol}^{-1}$)

(a) 0.955 M and 1.910 M
 (b) 1.910 M and 0.955 M
 (c) 1.90 M and 1.910 M
 (d) 0.477 M and 0.477 M (2010)

42. 10 g of hydrogen and 64 g of oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be

45. Molarity of liquid HCl, if density of solution is 1.17 g/ccis
(a) 36.5 (b) 18.25
(c) 32.05 (d) 42.10 (2001)

47. In the reaction,
 $4\text{NH}_{3(g)} + 5\text{O}_{2(g)} \rightarrow 4\text{NO}_{(g)} + 6\text{H}_2\text{O}_{(l)}$
 when 1 mole of ammonia and 1 mole of O₂ are made to react to completion
 (a) all the oxygen will be consumed
 (b) 1.0 mole of NO will be produced
 (c) 1.0 mole of H₂O is produced
 (d) all the ammonia will be consumed. (1998)

48. The amount of zinc required to produce 224 mL of H₂ at STP on treatment with dilute H₂SO₄ will be
 (a) 65 g (b) 0.065 g (c) 0.65 g (d) 6.5 g (1996)
 49. At STP the density of CCl₄ vapour in g/L will be nearest to
 (a) 6.87 (b) 3.42 (c) 10.26 (d) 4.57 (1988)

ANSWER KEY

1. (b) 2. (d) 3. (c) 4. (a) 5. (b) 6. (c) 7. (c) 8. (d) 9. (a) 10. (d)
 11. (a) 12. (a) 13. (a) 14. (c) 15. (d) 16. (c) 17. (b) 18. (a) 19. (b) 20. (a)
 21. (d) 22. (a) 23. (a) 24. (c) 25. (b) 26. (a) 27. (a) 28. (d) 29. (c) 30. (a)
 31. (c) 32. (d) 33. (c) 34. (c) 35. (b) 36. (c) 37. (a) 38. (a) 39. (d) 40. (b)
 41. (b) 42. (b) 43. (b) 44. (c) 45. (c) 46. (b) 47. (a) 48. (c) 49. (a)

Hints & Explanations

1. (b) : Pressure = $\frac{\text{Force}}{\text{Area}}$

Therefore, dimensions of pressure = $\frac{\text{MLT}^{-2}}{\text{L}^2} = \text{ML}^{-1}\text{T}^{-2}$
 and dimensions of energy per unit volume
 $= \frac{\text{Energy}}{\text{Volume}} = \frac{\text{ML}^2\text{T}^{-2}}{\text{L}^3} = \text{ML}^{-1}\text{T}^{-2}$

2. (d) : Zeros placed left to the number are never significant, therefore the no. of significant figures for the numbers 161 cm, 0.161 cm and 0.0161 cm are same, i.e., 3.

3. (c) : According to Avogadro's hypothesis, ratio of the volumes of gases will be equal to the ratio of their no. of moles.

So, no. of moles = $\frac{\text{Mass}}{\text{Mol. mass}}$

$$n_{\text{H}_2} = \frac{w}{2}; n_{\text{O}_2} = \frac{w}{32}; n_{\text{CH}_4} = \frac{w}{16}$$

So, the ratio is $\frac{w}{2} : \frac{w}{32} : \frac{w}{16}$ or 16 : 1 : 2.

4. (a) : $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$

1 vol. 5 vol. 3 vol. 4 vol.
 According to the above equation,
 1 vol. or 1 litre of propane requires 5 vol. or 5 litres of O₂ to burn completely.

5. (b) : Weight of gas = 0.24 g,
 Volume of gas = 45 mL = 0.045 litre and density of H₂ = 0.089 g/L
 Weight of 45 mL of H₂ = density × volume
 $= 0.089 \times 0.045 = 4.005 \times 10^{-3} \text{ g}$

Therefore, vapour density

$$= \frac{\text{Weight of certain volume of substance}}{\text{Weight of same volume of hydrogen}} = \frac{0.24}{4.005 \times 10^{-3}} = 59.93$$

6. (c) : If 1 L of one gas contains N molecules, 2 L of any gas under the same conditions will contain 2N molecules.

7. (c) : $\text{C}_2\text{H}_4 + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 2\text{H}_2\text{O}$

For complete combustion,
 $2.8 \text{ kg of C}_2\text{H}_4 \text{ requires } \frac{96}{28} \times 2.8 \times 10^3 \text{ g}$
 $= 9.6 \times 10^3 \text{ g} = 9.6 \text{ kg of O}_2$

8. (d) : Average isotopic mass of X

$$= \frac{200 \times 90 + 199 \times 8 + 202 \times 2}{90 + 8 + 2} = \frac{18000 + 1592 + 404}{100} = 199.96 \text{ amu} \approx 200 \text{ amu}$$

9. (a) : Average atomic mass = $\frac{19 \times 10 + 81 \times 11}{100} = 10.81$

10. (d) : 1 mole of substance = N_A atoms

$$108 \text{ g of Ag} = N_A \text{ atoms} \Rightarrow 1 \text{ g of Ag} = \frac{N_A}{108} \text{ atoms}$$

$$24 \text{ g of Mg} = N_A \text{ atoms} \Rightarrow 1 \text{ g of Mg} = \frac{N_A}{24} \text{ atoms}$$

$$32 \text{ g of O}_2 = N_A \text{ molecules} = 2 N_A \text{ atoms}$$

$$\Rightarrow 1 \text{ g of O}_2 = \frac{N_A}{16} \text{ atoms}$$

$$7 \text{ g of Li} = N_A \text{ atoms} \Rightarrow 1 \text{ g of Li} = \frac{N_A}{7} \text{ atoms}$$

Therefore, 1 g of Li_(s), has maximum number of atoms.

11. (a) : (a) Mass of water = $V \times d = 18 \times 1 = 18 \text{ g}$

$$\text{Molecules of water} = \text{mole} \times N_A = \frac{18}{18} N_A = N_A$$

(b) Molecules of water = mole $\times N_A = \frac{0.18}{18} N_A$

$$(c) \text{ Moles of water} = \frac{0.00224}{22.4} = 10^{-4}$$

$$\text{Molecules of water} = \text{mole} \times N_A = 10^{-4} N_A$$

(d) Molecules of water = mole $\times N_A = 10^{-3} N_A$

12. (a) : Let atomic weight of element X is x and that of

element Y is $\frac{y}{w}$
For XY, $n = \frac{y}{w}$

$$0.1 = \frac{10}{x+2y} \text{ Mol. wt.} \Rightarrow x+2y = \frac{10}{0.1} = 100 \quad \dots(i)$$

$$\text{For } X_3Y_2, n = \frac{9}{3x+2y} \text{ Mol. wt.} \Rightarrow 3x+2y = \frac{9}{0.05} = 180 \quad \dots(ii)$$

On solving equations (i) and (ii), we get $x = 40$

$$40 + 2y = 100 \Rightarrow 2y = 60 \Rightarrow y = 30$$

13. (a) : Mass of 1 mol (6.022×10^{23} atoms) of carbon = 12 g

If Avogadro number is changed to 6.022×10^{20} atoms then mass of 1 mol of carbon

$$= \frac{12 \times 6.022 \times 10^{20}}{6.022 \times 10^{23}} = 12 \times 10^{-3} \text{ g}$$

14. (c) : 1.8 gram of water = $\frac{6.023 \times 10^{23}}{18} \times 1.8 = 6.023 \times 10^{22} \text{ molecules}$

18 gram of water = $6.023 \times 10^{23} \text{ molecules}$

18 moles of water = $18 \times 6.023 \times 10^{23} \text{ molecules}$

15. (d) : Number of moles of H₂ = 1/2

Number of moles of O₂ = $\frac{4}{32}$

Hence, molar ratio = $\frac{1}{4} : \frac{4}{32} = 1 : 4$

16. (c) : 2 32

8 g H₂ has 4 moles while the others has 1 mole each.

17. (b) : No. of atoms = $N_A \times \frac{\text{No. of moles}}{23} \times 3 = 6.023 \times 10^{23} \times 0.1 \times 3 = 1.806 \times 10^{23}$

18. (a) : At STP, 22.4 L = 6.023×10^{23} molecules

$$15 \text{ LH} = \frac{6.023 \times 10^{23} \times 15}{22.4} = 4.033 \times 10^{23} \text{ molecules}$$

$$2 \quad 22.4$$

$$5 \text{ L N}_2 = \frac{6.023 \times 10^{23} \times 5}{22.4} = 1.344 \times 10^{23} \text{ molecules}$$

$$2 \text{ g H}_2 = 6.023 \times 10^{23} \text{ molecules}$$

$$0.5 \text{ g H}_2 = \frac{6.023 \times 10^{23} \times 0.5}{2} = 1.505 \times 10^{23} \text{ molecules}$$

$$32 \text{ g O}_2 = 6.023 \times 10^{23} \text{ molecules}$$

$$10 \text{ g of O}_2 = \frac{6.023 \times 10^{23} \times 10}{32} = 1.882 \times 10^{23} \text{ molecules}$$

19. (b) : Number of molecules = moles $\times N_A$

$$\text{Molecules of N}_2 = \frac{1}{7} N_A = 0.5 N_A$$

$$14$$

$$\text{Molecules of H}_2 = N_A$$

$$\text{Molecules of NO}_2 = \frac{16}{46} N_A = 0.35 N_A$$

$$\text{Molecules of O}_2 = \frac{16}{32} N_A = 0.5 N_A$$

∴ 2 g H₂ (1 mole H₂) contains maximum molecules.

20. (a) : Specific volume (vol. of 1 g) of cylindrical virus particle = $6.02 \times 10^{-2} \text{ cc/g}$

$$\text{Radius of virus, } r = 7 \text{ } \text{\AA} = 7 \times 10^{-8} \text{ cm}$$

$$\text{Volume of virus} = \pi r^2 l$$

$$= \frac{22}{7} \times (7 \times 10^{-8})^2 \times 10 \times 10^{-8} = 154 \times 10^{-23} \text{ cc}$$

$$\text{wt. of one virus particle} = \frac{\text{Volume(cc)}}{\text{Specific volume(cc/g)}}$$

$$= \frac{154 \times 10^{-23}}{6.02 \times 10^{-2}} \text{ g}$$

$$\therefore \text{Molecular wt. of virus} = \text{wt. of } N \text{ particles}$$

$$= \frac{154 \times 10}{6.02 \times 10^{-2}} \times 6.02 \times 10^{23} \text{ g/mol}$$

$$= 15400 \text{ g/mol} = 15.4 \text{ kg/mol}$$

21. (d) : 17 g of NH₃ = $4N_A$ atoms

$$4.25 \text{ g of NH}_3 = \frac{4N_A}{17} \times 4.25 \text{ atoms}$$

$$= N_A \text{ atoms} = 6 \times 10^{23} \text{ atoms}$$

22. (a) : Quantity of iron in one molecule = $\frac{67200}{100} \times 0.334 = 224.45 \text{ amu}$

$$\text{No. of iron atoms in one molecule of haemoglobin} = \frac{224.45}{56} = 4$$

23. (a) : Volume of oxygen in one litre of air

$$= \frac{21}{100} \times 1000 = 210 \text{ mL}$$

$$\text{Therefore, no. of moles} = \frac{210}{22400} = 0.0093 \text{ mol}$$

24. (c) : Each nitrogen atom has 5 valence electrons, therefore total number of valence electrons in N_3^- ion is 16. Since the molecular mass of N_3^- is 42, therefore total number of valence electrons in 4.2 g of N^- ion

$$= \frac{4.2}{42} \times 16 \times N_A = 1.6 N_A$$

25. (b) : Avogadro's no., $N_A = 6.02 \times 10^{23}$ molecules = 1 mole

$$\therefore 6.02 \times 10^{24} \text{ CO molecules} = 10 \text{ moles CO} \\ = 10 \text{ g atoms of O} = 5 \text{ g molecules of O}_2$$

26. (a) : Here, $C_p/C_v = 1.4$, which shows that the gas is diatomic.

$$22.4 \text{ L at NTP} = 6.02 \times 10^{23} \text{ molecules}$$

$$\therefore 11.2 \text{ L at NTP} = 3.01 \times 10^{23} \text{ molecules}$$

Since gas is diatomic,

$$\therefore 11.2 \text{ L at NTP} = 2 \times 3.01 \times 10^{23} \text{ atoms} \\ = 6.02 \times 10^{23} \text{ atom}$$

27. (a) : 1 mol of CO_2 = 44 g of CO_2

$$\therefore 4.4 \text{ g } \text{CO}_2 = 0.1 \text{ mol } \text{CO}_2 = 6 \times 10^{22} \text{ molecules}$$

[Since, 1 mole CO_2 = 6×10^{23} molecules]

$$= 2 \times 6 \times 10^{22} \text{ atoms of O} = 1.2 \times 10^{23} \text{ atoms of O}$$

28. (d) : As we know,

22400 cc of N_2O contain 6.02×10^{23} molecules

$$\therefore 1 \text{ cc of } \text{N}_2\text{O} \text{ contain } \frac{6.02 \times 10^{23}}{22400} \text{ molecules}$$

Since in N_2O molecule there are 3 atoms

$$\therefore 1 \text{ cc N O} = \frac{3 \times 6.02 \times 10^{23}}{22400} \text{ atoms} = \frac{1.8 \times 10^{22}}{224} \text{ atoms}$$

No. of electrons in a molecule of $\text{N}_2\text{O} = 7 + 7 + 8 = 22$

Hence, no. of electrons in 1 cc of N_2O

$$= \frac{6.02 \times 10^{23}}{22400} \times 22 \text{ electrons} = \frac{1.32}{224} \times 10^{23} \text{ electrons}$$

29. (c) :

Element	%	Atomic mass	Mole	Simple ratio
C	38.71	12	$\frac{38.71}{12} = 3.22$	$\frac{3.22}{3.22} = 1$
H	9.67	1	$\frac{9.67}{1} = 9.67$	$\frac{9.67}{3.22} = 3$
O	51.62	16	$\frac{51.62}{16} = 3.22$	$\frac{3.22}{3.22} = 1$

Hence, empirical formula of the compound would be CH_3O .

30. (a) : In peroxidase anhydrous enzyme, 0.5% Se is present means, 0.5 g Se is present in 100 g of enzyme. In a molecule of enzyme one Se atom must be present. Hence,

78.4 g Se will be present in $\frac{100}{0.5} \times 78.4 = 1.568 \times 10^4$

\therefore Minimum molecular weight of enzyme is 1.568×10^4 .

31. (c) : Urea (NH_2CONH_2), % of N = $\frac{28}{60} \times 100 = 46.66\%$

Similarly, % of N in other compounds are :
 $(\text{NH}_4)_2\text{SO}_4 = 21.2\%$; $\text{CaCN}_2 = 35.0\%$ and $\text{NH}_4\text{NO}_3 = 35.0\%$

32. (d) : Haber's process, $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

2 moles of NH_3 are formed by 3 moles of H_2 .

\therefore 20 moles of NH_3 will be formed by 30 moles of H_2 .

33. (c) : Density = 1.28 g/cc,

Conc. of solution = 2 M

Molar mass of $\text{NaOH} = 40 \text{ g mol}^{-1}$

Volume of solution = 1 L = 1000 mL

Mass of solution = $d \times V = 1.28 \times 1000 = 1280 \text{ g}$

Mass of solute = $n \times \text{Molar mass} = 2 \times 40 = 80 \text{ g}$

Mass of solvent = $(1280 - 80) \text{ g} = 1200 \text{ g}$

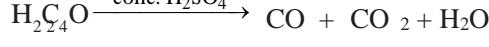
Number of moles of solute = $\frac{80}{40} = 2$

\therefore Molality = $\frac{2 \times 1000}{1200} = 1.67 \text{ m}$

34. (c) : $\text{HCOOH} \xrightarrow[\text{conc. H}_2\text{SO}_4]{\text{Dehydrating agent}} \text{CO} + \text{H}_2\text{O}$

$$n_i = \frac{2.3}{46} = \frac{1}{20} \quad 0 \quad 0$$

$$n_f = 0 \quad \frac{1}{20} \quad \frac{1}{20}$$



$$n_i = \frac{4.5}{90} = \frac{1}{20} \quad 0 \quad 0 \quad 0$$

$$n_f = 0 \quad \frac{1}{20} \quad \frac{1}{20} \quad \frac{1}{20}$$

H_2O gets absorbed by conc. H_2SO_4 . Gaseous mixture (containing CO and CO_2) when passed through KOH pellets, CO_2 gets absorbed.

Moles of CO left (unabsorbed) = $\frac{1}{20} + \frac{1}{20} = \frac{1}{10}$

Mass of CO = moles \times molar mass = $\frac{1}{10} \times 28 = 2.8 \text{ g}$

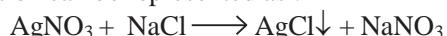
35. (b) : 16.9% solution of AgNO_3 means 16.9 g of AgNO_3 in 100 mL of solution.

= 8.45 g of AgNO_3 in 50 mL solution.

Similarly, 5.8 g of NaCl in 100 mL solution

= 2.9 g of NaCl in 50 mL solution.

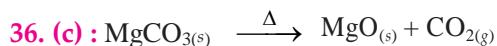
The reaction can be represented as :



$$\begin{array}{ccccc} \text{Initial} & 8.45/170 & 2.9/58.5 & 0 & 0 \\ \text{mole} & = 0.049 & = 0.049 & & \end{array}$$

$$\text{Final moles} \quad 0 \quad 0 \quad 0.049 \quad 0.049$$

\therefore Mass of AgCl precipitated = $0.049 \times 143.3 = 7.02 \approx 7 \text{ g}$



$$84 \text{ g of } \text{MgCO}_3 \equiv 40 \text{ g of } \text{MgO}$$

$$\therefore 20 \text{ g of } \text{MgCO}_3 \equiv \frac{40}{84} \times 20 = 9.52 \text{ g of MgO}$$

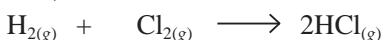
$$\text{Actual yield} = 8 \text{ g of MgO}$$

$$\therefore \% \text{ purity} = \frac{8}{9.52} \times 100 = 84\%$$

37. (a) : 1 mole \equiv 22.4 litres at STP.

$$n_{\text{H}_2} = \frac{22.4}{22.4} = 1 \text{ mol}; n_{\text{Cl}_2} = \frac{11.2}{22.4} = 0.5 \text{ mol}$$

Reaction is as,



Initial	1 mol	0.5 mol	0
Final	$(1 - 0.5)$	$(0.5 - 0.5)$	2×0.5
	= 0.5 mol	= 0 mol	1 mol

Here, Cl_2 is limiting reagent. So, 1 mole of $\text{HCl}_{(g)}$ is formed.

$$38. (\text{a}) : n_{\text{Mg}} = \frac{1}{24} = 0.0416 \text{ moles}$$

$$n_{\text{O}_2} = \frac{0.56}{32} = 0.0175 \text{ mole}$$

The balanced equation is



Initial	0.0416 mole	0.0175 mole	0
Final	$(0.0416 - 2 \times 0.0175)$	0	2×0.0175
	= 0.0066 mole		

Here, O_2 is limiting reagent.

$$\therefore \text{Mass of Mg left in excess} = 0.0066 \times 24 = 0.16 \text{ g}$$

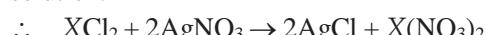
$$39. (\text{d}) : \text{Moles of urea} = \frac{1}{6.02 \times 10^{23}} = 0.001$$

$$\text{Concentration of solution} = \frac{0.001}{100} \times 1000 = 0.01 \text{ M}$$

$$40. (\text{b}) : \text{Millimoles of solution of chloride} = 0.05 \times 10 = 0.5$$

$$\text{Millimoles of AgNO}_3 \text{ solution} = 10 \times 0.1 = 1$$

So, the millimoles of AgNO_3 are double than the chloride solution.



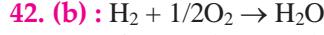
$$41. (\text{b}) : \text{Given that molar mass of } \text{Na}_2\text{CO}_3 = 106 \text{ g}$$

$$\therefore \text{Molarity of solution} = \frac{25.3 \times 1000}{106 \times 250} = 0.955 \text{ M}$$



$$[\text{Na}^+]_2 = 2[\text{Na}_2\text{CO}_3] = 2 \times 0.955 = 1.910 \text{ M}$$

$$[\text{CO}_3^{2-}] = \frac{2}{3}[\text{Na}^+] = \frac{2}{3} \times 1.910 = 1.307 \text{ M}$$



$$\begin{array}{ccc} 2 \text{ g} & 16 \text{ g} & 18 \text{ g} \\ 1 \text{ mol} & 0.5 \text{ mol} & 1 \text{ mol} \end{array}$$

$$10 \text{ g of H}_2 = 5 \text{ mol and } 64 \text{ g of O}_2 = 2 \text{ mol}$$

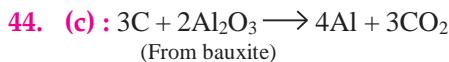
\therefore In this reaction, oxygen is the limiting reagent so amount of H_2O produced depends on the amount of O_2 . Since 0.5 mol of O_2 gives 1 mol of H_2O

\therefore 2 mol of O_2 will give 4 mol of H_2O



$$\begin{array}{ccc} \frac{6.5}{224} \text{ mol} & \frac{3.2}{36.5} \text{ mol} \\ & \\ & = 0.029 \text{ mol} = 0.087 \text{ mol} \end{array}$$

Formation of moles of lead(II) chloride depends upon the no. of moles of PbO which acts as a limiting reagent here. So, no. of moles of PbCl_2 formed will be equal to the no. of moles of PbO i.e. 0.029.



4 moles of Al is produced by 3 moles of C.

1 mole of Al is produced by $\frac{3}{4}$ mole of C.

$$\frac{270 \times 1000}{27} = 10^4 \text{ moles of Al is produced by } \frac{3}{4} \times 10^4 \text{ moles of C.}$$

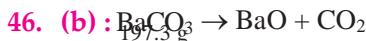
Amount of carbon used = $\frac{3}{4} \times 10^4 \times 12 \text{ g}$

$$= \frac{3}{4} \times 10 \times 12 \text{ kg} = 90 \text{ kg}$$

45. (c) : Density = 1.17 g/cc.

\Rightarrow 1 cc. solution contains 1.17 g of HCl

$$\therefore \text{Molarity} = \frac{1.17 \times 1000}{36.5 \times 1} = 32.05$$



$$\begin{array}{c} \frac{22.4}{9.85} \text{ L at N.T.P.} \\ \frac{22.4}{197.3} \times 9.85 \\ = 1.118 \text{ L} \end{array}$$

\Rightarrow 9.85 g of BaCO_3 will produce 1.118 L of CO_2 at N.T.P. on the complete decomposition.



$$4 \text{ moles} \quad 5 \text{ moles} \quad 4 \text{ moles} \quad 6 \text{ moles}$$

\Rightarrow 1 mole of NH_3 requires $= \frac{5}{4} = 1.25$ mole of oxygen while 1 mole of O_2 requires $= \frac{4}{5} = 0.8$ mole of NH_3 . Therefore, all oxygen will be consumed.



$$65 \text{ g} \quad 22400 \text{ mL}$$

Since 65 g of zinc reacts to liberate 22400 mL of H_2 at STP, therefore amount of zinc needed to produce 224 mL of H_2 at STP = $\frac{65}{22400} \times 224 = 0.65 \text{ g}$

$$= \frac{65}{22400} \times 224 = 0.65 \text{ g}$$



$$= 12 + 4 \times 35.5 = 154 \text{ g}$$

$$\therefore \text{Density of } \text{CCl}_4 \text{ vapour} = \frac{154}{22.4} \text{ g L}^{-1} = 6.875 \text{ g L}^{-1}$$