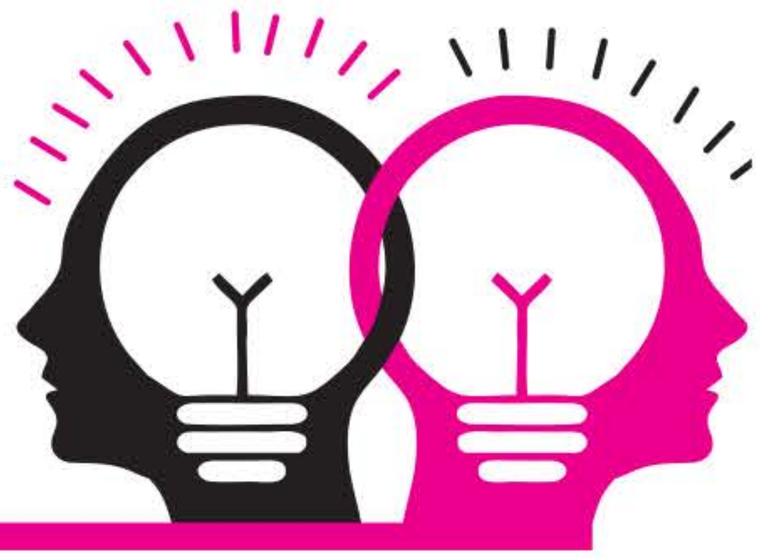
EXAMINER'S MIND CLASS XI



The questions given in this column have been prepared strictly on the basis of NCERT Chemistry for Class XI.
This year JEE (Main & Advanced)/NEET/AIIMS have drawn their papers heavily from NCERT books.

Section - I	Q. 1 to 10 Only One Option Correct Type MCQs.
Section - II	Q. 11 to 13 More than One Options Correct Type MCQs.
Section - III	Q. 14 to 17 Paragraph Type MCQs having Only One Option Correct.
Section - IV	Q. 18 & 19 Matching List Type MCQs having Only One Option Correct.
Section - V	Q. 20 to 22 Assertion Reason Type MCQs having Only One Option Correct. Mark the correct choice as : (a) If both assertion and reason are true and reason is the correct explanation of assertion. (b) If both assertion and reason are true but reason is not the correct explanation of assertion. (c) If assertion is true but reason is false. (d) If both assertion and reason are false.
Section - VI	Q. 23 to 25 Integer Value Correct Type Questions having Single Digit Integer Answer, ranging from 0 to 9 (both inclusive).

SOME BASIC CONCEPTS OF CHEMISTRY

SECTION - I

Only One Option Correct Type

1. 112.0 mL of NO_2 at STP was liquefied, the density of the liquid being 1.15 g mL^{-1}. The volume of the liquid and the number of molecules in the liquid NO_2 respectively are
(a) 0.10 mL and 3.01×10^{22}
(b) 0.20 mL and 3.01×10^{21}
(c) 0.20 mL and 6.02×10^{23}
(d) 0.40 mL and 6.02×10^{21}

2. A mixture of CO and CO_2 having a volume of 20 mL is mixed with x mL of oxygen and electrically sparked. The volume after explosion is $(16 + x)$ mL under the same conditions. What would be the residual volume if 30 mL of the original mixture is treated with aqueous NaOH?
(a) 12 mL (b) 10 mL (c) 9 mL (d) 8 mL

3. 50 litres of water containing $Ca(HCO_3)_2$ when converted into soft water required 22.2 g $Ca(OH)_2$. The amount of $Ca(HCO_3)_2$ present per litre of hard water is
(a) 0.220 g L^{-1} (b) 1.431 g L^{-1}
(c) 0.972 g L^{-1} (d) 1.241 g L^{-1}

4. In the reaction,
$4NH_{3(g)} + 5O_{2(g)} \longrightarrow 4NO_{(g)} + 6H_2O_{(l)}$
when 1 mol of ammonia and 1 mol of O_2 are made to react to completion then
(a) 1.0 mol of H_2O will be produced
(b) 1.0 mol of NO will be produced
(c) all the ammonia will be consumed
(d) all the oxygen will be consumed.

5. Concentrated aqueous sulphuric acid is 98% H_2SO_4 by mass and has a density of 1.80 g mL^{-1}. Volume of acid required to make one litre of 0.1 M H_2SO_4 solution is
(a) 11.10 mL (b) 16.65 mL
(c) 22.20 mL (d) 5.55 mL

6. The balancing of chemical equations is based upon the law of
(a) combining volumes
(b) multiple proportions
(c) conservation of mass
(d) definite proportions.

7. The density of a liquid is 1.2 g/mL. There are 35 drops in 2 mL. The number of molecules in one drop are (molar mass of liquid = 70)
(a) $\left(\frac{1.2}{35}\right)N_A$ (b) $\left(\frac{1}{35}\right)^2 N_A$
(c) $\frac{1.2}{(35)^2}N_A$ (d) $1.2N_A$

8. Chlorophyll, the green colouring matter of plants responsible for photosynthesis, contains 2.68% of magnesium by mass, then number of magnesium atoms in 2.00 g of chlorophyll is
(a) 2.345×10^{21} atoms of Mg
(b) 2.924×10^{21} atoms of Mg
(c) 1.942×10^{21} atoms of Mg
(d) 1.343×10^{21} atoms of Mg.

9. 250 mL of xM solution and 500 mL of yM solution of a solute are mixed and diluted to 2 L to produce a solution having concentration 1.6 M. If $x : y = 5 : 4$, then $x + y$ is
(a) 8.06 (b) 8.86 (c) 9.8 (d) 12.6

10. The vapour density of a mixture containing NO_2 and N_2O_4 is 38.3 at 300 K. The number of moles of NO_2 in 100 g of the mixture is approximately
(a) 0.44 (b) 4.4 (c) 33.4 (d) 3.34

SECTION - II

More than One Options Correct Type

11. A solution contains 25% water, 25% ethanol (C_2H_5OH) and 50% acetic acid (CH_3COOH) by mass. The mole fraction of
(a) Water = 0.502 (b) Ethanol = 0.302
(c) Acetic acid = 0.196
(d) Ethanol + acetic acid = 0.497

12. In $MgSO_4$ (At. mass : Mg = 24, S = 32, O = 16), the mass percentage of
(a) Mg = 80% (b) Mg = 20%
(c) S = 26.7% (d) S = 53.3%

13. The following substances are present in different containers
(i) one gram atom of nitrogen
(ii) one mole of calcium
(iii) one atom of silver
(iv) one mole of oxygen molecules
(v) 10^{23} atoms of carbon
(vi) One gram of iron.
The correct order of increasing masses (in grams) is/are
(a) (iii) < (iv) < (i) < (v) (b) (iii) < (vi) < (iv) < (ii)
(c) (vi) < (v) < (i) < (iv) (d) (iii) < (ii) < (v) < (iv)

SECTION - III

Paragraph Type

Paragraph for Questions 14 and 15

A crystalline hydrated salt on being rendered anhydrous loses 45.6% of its weight.
The percentage composition of anhydrous salt is :
Al = 10.5%, K = 15.1%, S = 24.8% and oxygen = 49.6%
[Molar mass : Al = 27, K = 39, S = 32]

14. What is the empirical formula of the salt?
(a) K_2AlSO_7 (b) $K_2Al_2SO_7$
(c) $KAlS_2O_8$ (d) $K_3AlS_2O_{12}$

15. What is the empirical formula of the hydrated salt?
(a) $K_2AlSO_7 \cdot 10H_2O$ (b) $K_2Al_2S_2O_7 \cdot 16H_2O$
(c) $K_3AlS_2O_{12} \cdot 8H_2O$ (d) $KAlS_2O_8 \cdot 12H_2O$

Paragraph for Questions 16 and 17

25 g of the explosive TNT is detonated in an evacuated 5 litre container, as follows :

$$2C_7H_5(NO_2)_{3(s)} \longrightarrow 12CO_{(g)} + 2C_{(s)} + 5H_{2(g)} + 3N_{2(g)}$$

16. The mass of carbon deposited is
(a) 0.32 g (b) 1.42 g (c) 2.32 g (d) 1.32 g

17. The final pressure (in atm) of the system at 230° C is
(a) 8.4 (b) 9.1 (c) 10.0 (d) 7.6

SECTION - IV

Matching List Type

18. Match the physical quantity given in List I with the units given in List II and select the correct answer using the codes given below the lists :

	List I		List II
(P)	Force	1.	J
(Q)	Energy	2.	s^{-1}
(R)	Frequency	3.	$kg\ m^2s^{-2}$
(S)	Work	4.	$kg\ ms^{-2}$

	P	Q	R	S
(a)	4	1,3	2	1,3
(b)	3	4	1	2
(c)	3	4	2	1
(d)	3	2	1	4

19. Match the List I with List II and select the correct answer using the codes given below the lists :

	List I	List II
(P)	Molality	1. Independent of temperature
(Q)	Molarity	2. $mol\ L^{-1}$
(R)	Mole fraction	3. $g\ equiv\ L^{-1}$
(S)	Normality	4. $mol\ kg^{-1}$

	P	Q	R	S
(a)	2, 4	3, 4	1, 4	3
(b)	1, 4	2, 4	1, 4	2
(c)	3, 4	1, 4	2, 4	3
(d)	1,4	2	1	3

SECTION - V

Assertion Reason Type

20. **Assertion :** The empirical and molecular formula of Na_2CO_3 is same.
Reason : Na_2CO_3 does not form hydrate.

21. **Assertion :** Atomic mass of potassium is 39.
Reason : An atom of potassium is 39 times heavier than $1/12^{th}$ of the mass of carbon atom (C^{12}).

22. **Assertion :** Both 138 g of K_2CO_3 and 12 g of carbon have same number of carbon atoms.
Reason : Both contain 1 g atom of carbon which contains 6.022×10^{23} carbon atoms.

SECTION - VI

Integer Value Correct Type

23. The number of significant figures up to which the result of the following may be expressed is

$$\frac{(29.4-21.4)(1.86\times10^{3})}{1.78}$$

24. Haemoglobin contains 0.334% of iron by weight. The molecular weight of haemoglobin is approximately 67200. The number of iron atom (at. wt. of Fe is 56) present in one molecule of haemoglobin are

25. The equivalent weight of a metal is 4.5 and the molecular weight of its chloride is 80. The atomic weight of the metal is

CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES

SECTION - I

Only One Option Correct Type

1. Electronic configurations of four elements *A*, *B*, *C* and *D* are given below :
(*A*) $1s^2\ 2s^2\ 2p^6$ (*B*) $1s^2\ 2s^2\ 2p^4$
(*C*) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (*D*) $1s^2\ 2s^2\ 2p^5$
Which of the following is the correct order of increasing tendency to gain electron?
(a) $A < C < B < D$ (b) $A < B < C < D$
(c) $D < B < C < A$ (d) $D < A < B < C$

2. Few elements are matched with their successive ionisation energies. Identify the elements.

Element	IE_1 (kJ/mol)	IE_2 (kJ/mol)
X	2372	5251
Y	520	7297
Z	900	1758

	X	***Y***	***Z***
(a)	A noble gas	Alkali metal	Alkaline earth metal
(b)	Alkali metal	A noble gas	Alkaline earth metal
(c)	Alkaline earth metal	Alkali metal	A noble gas
(d)	Alkali metal	Alkaline earth metal	A noble gas

3. The statement that is not correct for periodic classification of elements is
(a) the properties of elements are periodic function of their atomic numbers
(b) non-metallic elements are less in number than metallic elements
(c) for transition elements, the 3*d*-orbitals are filled with electrons after 3*p*-orbitals and before 4*s*-orbitals
(d) the first ionisation enthalpies of elements generally increase with increase in atomic number as we go along a period.

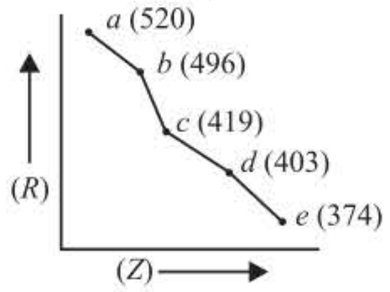
4. Predict the formula of stable compound formed by an element '*A*' with atomic number 114 and fluorine.
(a) AF_3 (b) AF_2 (c) AF (d) AF_4

5. Which among the following factors is the most important in making fluorine the strongest oxidising halogen?
(a) Electron affinity
(b) Bond dissociation energy
(c) Hydration enthalpy
(d) Ionisation enthalpy

6. Which of the following is a favourable factor for cation formation?
(a) High electronegativity
(b) High electron affinity
(c) Low ionisation potential
(d) Smaller atomic size

7. How much energy must be needed to convert all the atoms of sodium to sodium ions present in 2.3 mg of sodium vapours? Ionisation enthalpy of sodium is 495 kJ mol^{-1} (At. mass of Na = 23).
(a) 47.5 J (b) 39.5 J (c) 48.0 J (d) 49.5 J

8. In the given graph, a periodic property (R) is plotted against atomic numbers (Z) of the elements. Which property is shown in the graph and how is it correlated with reactivity of the elements?



(a) Ionisation enthalpy in a group, reactivity decreases from $a \rightarrow e$.
(b) Ionisation enthalpy in a group, reactivity increases from $a \rightarrow e$.
(c) Atomic radius in a group, reactivity decreases from $a \rightarrow e$.
(d) Metallic character in a group, reactivity increases from $a \rightarrow e$.

9. Fill in the blanks with appropriate option.
The ability of an atom to attract shared electrons to itself is called __(i)__ . It is generally measured on the __(ii)__ scale. An arbitrary value of __(iii)__ is assigned to fluorine (have greatest ability to attract electrons). It generally __(iv)__ across a period and __(v)__ down a group.

	(i)	(ii)	(iii)	(iv)	(v)
(a)	polarity	Pauling	2.0	decreases	increases
(b)	electro-negativity	Pauling	4.0	increases	decreases
(c)	valency	Mulliken	1.0	decreases	increases
(d)	electron affinity	Mulliken	2.0	increases	increases

10. A neutral atom (A) is converted to (A^{3+}) by the following process :

$$A \xrightarrow[-e^-]{E_1} A^+ \xrightarrow[-e^-]{E_2} A^{2+} \xrightarrow[-e^-]{E_3} A^{3+}$$

The correct order of E_1, E_2 and E_3 energies is
(a) $E_1 < E_2 < E_3$ (b) $E_1 > E_2 > E_3$
(c) $E_1 = E_2 = E_3$ (d) $E_1 > E_2 < E_3$

SECTION - II

More than One Options Correct Type

11. Among the following identify the correct statements .
(a) Amongst isoelectronic species, smaller the positive charge on the cation, smaller is the ionic radius.
(b) Amongst isoelectronic species, greater the negative charge on the anion, larger is the ionic radius.
(c) Atomic radius of the elements increases on moving down the first group of the periodic table.
(d) Atomic radius of the elements decreases on moving across the period of the periodic table.

12. Which of the following sets contain only isoelectronic ions?
(a) $P^{3-}, S^{2-}, Cl^-, K^+$ (b) Na^+, K^+, Cl^-, F^-
(c) $Ti^{4+}, Sc^{3+}, Cl^-, Ar$ (d) O^{2-}, Na^{2+}, F^-, Ar

13. Which of the following statements are not correct?
(a) Germanium was earlier called eka-silicon.
(b) Moseley introduced the concept of atomic number as the basis of modern periodic law.
(c) 14 elements of 5^{th} period are called lanthanoids.
(d) 4^{th} period begins with rubidium.

SECTION - III

Paragraph Type

Paragraph for Questions 14 and 15

The amount of energy released when a neutral isolated gaseous atom accepts an electron to form gaseous anion is called electron affinity.

$$O_{(g)} + e^- \xrightarrow{\text{Exothermic}} O^-_{(g)} \quad \ldots(i)$$

$$O^-_{(g)} + e^- \xrightarrow{\text{Endothermic}} O^{2-}_{(g)} \quad \ldots(ii)$$

In (ii), the energy has to be supplied for addition of second electron due to repulsion between an anion and extra electron. The members of third period have higher electron affinity value than members of second period.

14. Considering the elements F, Cl, O and S correct order of their electron affinity value is
(a) F > Cl > O > S (b) F > O > Cl > S
(c) Cl > F > S > O (d) O > F > S > Cl

15. Which process involves maximum release of energy?
(a) $O_{(g)} + e^- \longrightarrow O^-_{(g)}$ (b) $S_{(g)} + e^- \longrightarrow S^-_{(g)}$
(c) $F_{(g)} + e^- \longrightarrow F^-_{(g)}$ (d) $Cl_{(g)} + e^- \longrightarrow Cl^-_{(g)}$

Paragraph for Questions 16 and 17

The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpies (in kJ mol^{-1}) and the electron gain enthalpy (in kJ mol^{-1}) of few elements are given below :

Elements	$\Delta_i H_1$	$\Delta_i H_2$	$\Delta_{eg} H$
A	520	7300	–60
B	419	3051	–48
C	1681	3374	–328
D	1008	1846	–295
E	2372	5251	+48
F	738	1451	–40

16. Which one of the given elements is most reactive non-metal?
(a) *C* (b) *D* (c) *E* (d) *A*

17. The metal which can form predominantly stable covalent halide of the formula *MX* (*X* = halogen) is
(a) *F* (b) *B* (c) *D* (d) *A*

SECTION - IV

Matching List Type

18. Match the entries of List I with appropriate entries of List II and select the correct answer using the codes given below the lists :

	List I		**List II**
(P)	Rutherfordium (At. No. = 104)	1.	Period number = 7
(Q)	Roentgenium (At. No. = 111)	2.	Group number = 4
(R)	Thorium (At. No. = 90)	3.	*d*-block elements
(S)	Neptunium (At. No. = 93)	4.	*f*-block elements

	P	**Q**	**R**	**S**
(a)	3	2,4	2,3	1,2,3
(b)	1,2,3	1,3	1,4	1,4
(c)	1,2	2,1	4,3	3,1
(d)	3,1	1,3	2,4	4,1,2

19. Match the entries of List I with appropriate entries of List II and select the correct answer using the codes given below the lists :

	List I		**List II**
(P)	A reactive, pale yellow gas; the atom has a large negative electron affinity	1.	Oxygen
(Q)	A soft metal that reacts with water to produce hydrogen	2.	Gallium
(R)	A metal that forms an oxide of formula, M_2O_3	3.	Barium
(S)	A colourless gas; the atom has moderately large negative electron affinity	4.	Fluorine

	P	**Q**	**R**	**S**
(a)	4	3	2	1
(b)	3	4	1	2
(c)	2	1	4	3
(d)	3	1	2	4

SECTION - V

Assertion Reason Type

20. **Assertion :** Generally, ionisation enthalpy increases from left to right in a period.
Reason : When successive electrons are added to the orbitals in the same principal quantum number, the shielding effect of inner core of electrons does not increase very much to compensate for the increased attraction of the electron to the nucleus.

21. **Assertion :** Boron has smaller first ionisation enthalpy than beryllium.
Reason : The penetration of a 2*s* electron to the nucleus is more than the 2*p* electron hence 2*p* electron is more shielded by the inner core of electrons than the 2*s* electrons.

22. **Assertion :** The elements having $1s^2\,2s^2\,2p^6\,3s^2$ and $1s^2\,2s^2$ configuration belong to same group.
Reason : These have same number of valence electrons.

SECTION - VI

Integer Value Correct Type

23. How many of the following elements are lanthanoids?
Cs, Ra, Sn, Sm, Pb, Er, Se, Gd

24. The element with atomic number 25 will be found in group _____.

25. *IE* and *EA* values of an element are 13.0 eV and 3.8 eV respectively. Its electronegativity on pauling scale is

SOLUTIONS

SOME BASIC CONCEPTS OF CHEMISTRY

1. (b) : Mass of NO_2 gas $= \frac{46}{22400} \times 112 = 0.23$ g

$\therefore$ Volume of liquid $= \frac{0.23}{1.15} = 0.20$ mL

Now, number of molecules in NO_2 liquid
= Number of moles × Avogadro's number
$= \frac{0.23}{46} \times 6.023 \times 10^{23} \approx 3.01 \times 10^{21}$

2. (a) : $CO + \frac{1}{2}O_2 \longrightarrow CO_2$

$CO_2 + O_2 \longrightarrow$ No reaction

Let a mL CO and b mL CO_2 be present in the mixture.

So, $a + b = 20$ …(i)

After the explosion a mL of CO_2 is formed so,

$$a + b + \frac{x}{2} = 16 + x$$

or $2a + 2b - x = 32$ … (ii)

From eqs. (i) and (ii), we get

$x = 8$ mL

Therefore, volume of CO in the mixture = 8 mL

∴ Volume of $CO_2 = 20 - 8 = 12$ mL

$CO_2 + 2NaOH \longrightarrow Na_2CO_3 + H_2O$

$CO + NaOH \longrightarrow$ No reaction

If 30 mL original mixture is used then

$$\text{volume of } CO_2 \text{ in the mixture} = \frac{12}{20} \times 30 = 18 \text{ mL}$$

and volume of CO left unreacted = 30 –18=12 mL

3. (c) : $\underset{162\text{ g}}{Ca(HCO_3)_2} + \underset{74\text{ g}}{Ca(OH)_2} \rightarrow 2CaCO_3 + 2H_2O$

74 g $Ca(OH)_2$ reacts with 162 g of $Ca(HCO_3)_2$

$$\therefore \quad 22.2 \text{ g of } Ca(OH)_2 \text{ will react with} = \frac{162 \times 22.2}{74}$$

$$= 48.6 \text{ g } Ca(HCO_3)_2$$

50 L water contains = 48.6 g $Ca(HCO_3)_2$

$$1 \text{ L water contains} = \frac{48.6}{50} = 0.972 \text{ g L}^{-1}$$

4. (d): According to stoichiometry, they should react as follows :

$$\underset{\substack{4\text{ mol}\\0.8\text{ mol}}}{4NH_{3(g)}} + \underset{\substack{5\text{ mol}\\1\text{ mol}}}{5O_{2(g)}} \longrightarrow \underset{\substack{4\text{ mol}\\0.8\text{ mol}}}{4NO_{(g)}} + \underset{\substack{6\text{ mol}\\1.2\text{ mol}}}{6H_2O_{(l)}}$$

In this reaction, 1 mole of O_2 and 0.8 mole of NH_3 are consumed thereby indicating complete consumption of O_2.

5. (d): H_2SO_4 is 98% by weight.

Weight of $H_2SO_4 = 98$ g

Weight of solution = 100 g

$$\text{Volume of solution} = \frac{\text{Mass}}{\text{Density}} = \frac{100}{1.80} \text{mL}$$

$$= 55.55 \text{ mL} = 0.0555 \text{ L}$$

$$\text{Molarity of solution} = \frac{98}{98 \times 0.0555} \approx 18.02 \text{ M}$$

Let V mL of H_2SO_4 be used to prepare one litre of 0.1 M H_2SO_4.

$V \times 18.02 = 1000 \times 0.1$

$$V = \frac{1000 \times 0.1}{18.02} = 5.55 \text{ mL}$$

6. (c) : In balancing of chemical equations, mass on both the sides of the reaction should be conserved. Hence, it is based on law of conservation of mass.

7. (c) : 70 g (1 mole) of the liquid has N_A molecules.

□□□ □≡□—□□ □□

$\frac{□□}{□□□}$ □□ has N_A molecules.

2 mL (or 35 drops) will have

$$= \frac{N_A}{□□} \times □□□ \times □ = \frac{□□□ \times N_A}{□□}$$

$$\text{Then 1 drop will have} = \frac{N_A \times □□□}{□□ \times □□} = \frac{□□□ \times N_A}{□□□□}$$

8. (d): 100 g chlorophyll contains 2.68 g Mg

$$= \frac{2.68}{24} \text{ mole of Mg}$$

$$2 \text{ g chlorophyll contains} = \frac{2.68 \times 2}{24 \times 100} \text{ mole of Mg}$$

$$= 2.23 \times 10^{-3} \text{ mole of Mg}$$

No. of Mg atoms $= 2.23 \times 10^{-3} \times 6.023 \times 10^{23}$

$= 1.343 \times 10^{21}$ atoms of Mg

9. (b): $250x + 500y = 1.6 \times 2000$

$$\frac{x}{y} = \frac{5}{4}$$

$x = 4.92$, $y = 3.94$ (approx.) Thus, $x + y = 8.86$

10. (a) : Molecular weight of the mixture $= 38.3 \times 2$

$= 76.6$

Let mass of NO_2 in mixture be x g.

Then, mass of $N_2O_4 = (100 - x)$ g

$$\text{Number of moles of } NO_2 = \frac{x}{46}$$

$$\text{Number of moles of } N_2O_4 = \frac{100 - x}{92}$$

(Molecular weight of $NO_2 = 46$, molecular weight of $N_2O_4 = 92$)

$$\frac{\text{Weight}}{\text{Number of moles}} = \text{Molecular weight}$$

$$\frac{x+(100-x)}{\frac{x}{46}+\frac{(100-x)}{92}}=76.6 \quad \Rightarrow \quad \frac{x}{46}+\frac{(100-x)}{92}=\frac{100}{76.6}$$

$\therefore \quad x = 20.1$

Number of moles of $NO_2 = \frac{20.1}{46} = 0.437 \approx 0.44$

11. (a,d) : Moles of water $= \frac{25}{18} = 1.388$

Moles of ethanol $= \frac{25}{46} = 0.543$

Moles of acetic acid $= \frac{50}{60} = 0.833$

Total moles = 1.388 + 0.543 + 0.833 = 2.764

$x_{(water)} = \frac{1.388}{2.764} = 0.502$

$x_{(ethanol)} = 0.196$

$x_{(acetic\ acid)} = 0.301$

$x_{(ethanol)} + x_{(acetic\ acid)} = 0.497$

12. (b,c): Molar mass $MgSO_4 = 24 + 32 + 4 \times 16 = 120$

Mass % of Mg $= \frac{24}{120} \times 100 = 20\%$

Mass % of S $= \frac{32}{120} \times 100 = 26.7\%$

13. (b, c) : (i) 14 g (ii) 40 g

(iii) $\frac{108}{6.022 \times 10^{23}} = 1.79 \times 10^{-22}$ g

(iv) 32 g (v) 1.99 g (vi) 1 g

Hence, the correct order of increasing masses is (iii) < (vi) < (v) < (i) < (iv) < (ii)

14. (c) :

Element	%	$\frac{\text{percentage mass}}{\text{At. mass}}$	Simplest ratio
Al	10.5	$\frac{10.5}{27} = 0.388$	1
K	15.1	$\frac{15.1}{39} = 0.387$	1
S	24.8	$\frac{24.8}{32} = 0.775$	2
O	49.6	$\frac{49.6}{16} = 3.1$	8

$\therefore$ Empirical formula = $KAlS_2O_8$

Assume molecular formula of hydrated salt

$= KAlS_2O_8 \cdot xH_2O$ then

$$\frac{18x}{39+27+64+128+18x} \times 100 = 45.6 \quad \Rightarrow \quad x = 12$$

$\therefore$ The empirical formula of salt is $KAlS_2O_8.12H_2O$

15. (d)

16. (d): $\underset{2 \times 227\ g}{2C_7H_5(NO_2)_{3(s)}} \longrightarrow \underset{12 \times 28\ g}{12CO_{(g)}} + \underset{2 \times 12\ g}{2C_{(s)}} + \underset{5 \times 2\ g}{5H_{2(g)}} + \underset{3 \times 28\ g}{3N_{2(g)}}$

Mass of carbon deposited from 25 g TNT

$$= \frac{2 \times 12}{2 \times 227} \times 25 = 1.32 \text{ g}$$

17. (b): Moles of TNT $= \frac{25}{227} = 0.11$ mole

Total moles of gaseous substance

$$= \frac{20}{2} \times 0.11 = 1.1 \text{ mole}$$

$\therefore$ Total pressure, $P = \frac{nRT}{V}$

$$= \frac{1.1}{5} \times 0.0821 \times (230+273) = 9.1 \text{ atm}$$

18. (a) **19. (d)** **20. (c)** **21. (a)**

22. (a) : 138 g K_2CO_3 = 1 mol $\equiv$ 1 g atom of C

12 g C = 1 g atom of C

23. (2) : Up to 2 significant figures because the difference of (29.4 – 21.4) *i.e.*, 8.0 contains 2 significant figures.

24. (4) : Percentage of iron in haemoglobin = 0.334%;

Molecular wt. of haemoglobin = 67200

Atomic weight of iron = 56

Number of Fe atoms

$$= \frac{\text{Mol. wt. of haemoglobin} \times \%\text{ of iron}}{100 \times \text{Atomic weight of iron}}$$

$$= \frac{67200 \times 0.334}{100 \times 56} = 4$$

25. (9) : Let metal chloride be MCl_x (Suppose metal is x valent), then molecular weight of MCl_x

=Equivalent weight of metal $\times x + x \times 35.5 = 80$

$4.5x + 35.5x = 80 \quad \therefore \quad x = 2$

$\therefore$ Atomic weight of metal = $4.5 \times 2 = 9$